# SOIL SURVEY OF
# Harris County, Texas

United States Department of Agriculture
Soil Conservation Service
In cooperation with the
Texas Agricultural Experiment Station and the
Harris County Flood Control District

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1969-72. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1972. This survey was made cooperatively by the Soil Conservation Service, the Texas Agricultural Experiment Station, and the Harris County Flood Control District. It is part of the technical assistance furnished to the Harris Soil and Water Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

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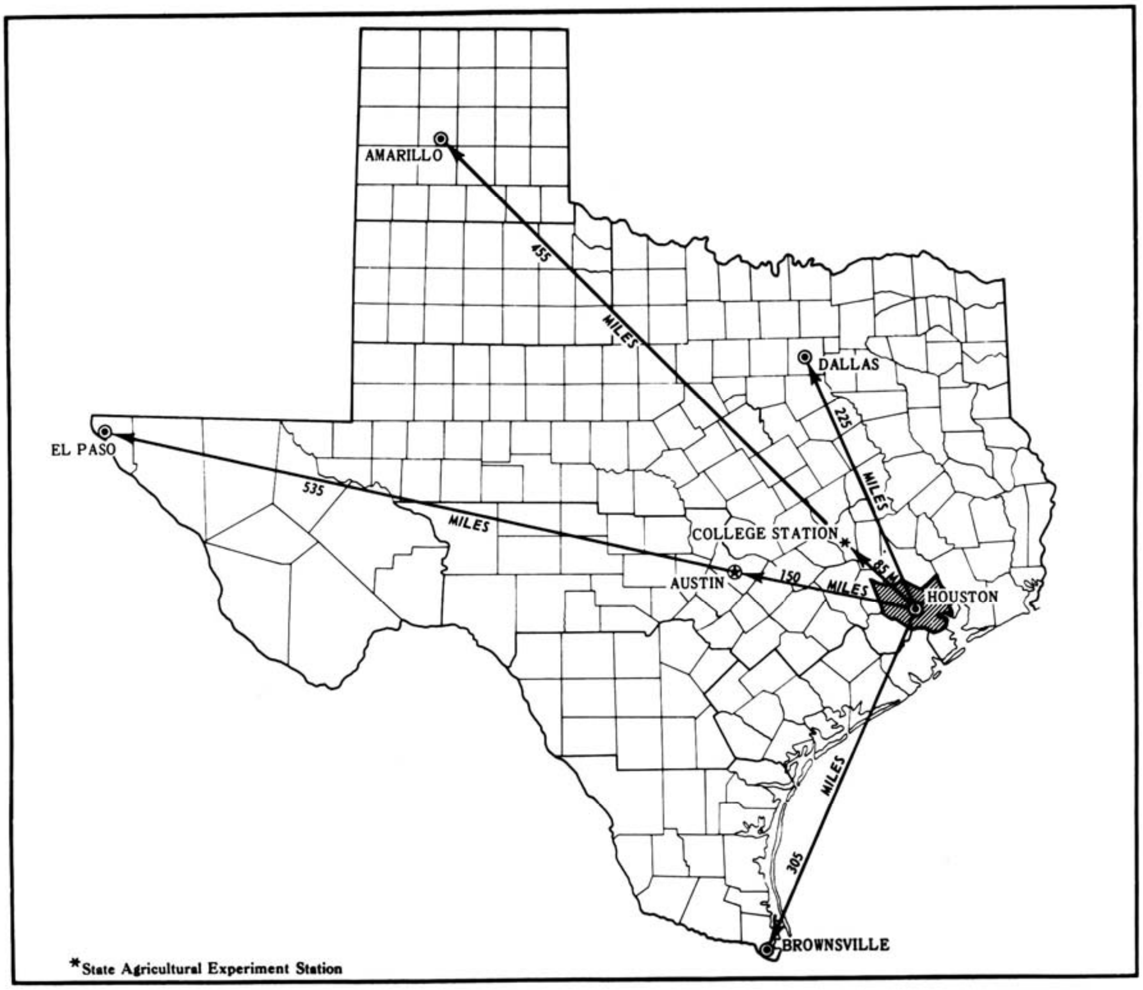


Location of Harris County in Texas

# SOIL SURVEY OF HARRIS COUNTY, TEXAS

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United States Department of Agriculture, Soil Conservation Service, in cooperation with the Texas Agricultural Experiment Station and the Harris County Flood Control District

## Introduction

HARRIS COUNTY is in the southeastern part of Texas (see facing page). Houston, the county seat, is about 25 miles south of the Montgomery County line on Interstate Highway 45. The city, the third largest seaport in the nation, is a leading center for petrochemicals and other manufactured goods, for banking, for pipeline transmission, for agribusiness, and for science-based industries. In 1970, the population of the county was 1,741,912. The population is rapidly increasing.

The county is irregular in shape, measuring about 35 miles from north to south and 50 miles from east to west. It covers 1,765 square miles, or 1,129,600 acres. About 40 percent of the county is urban land, 25 percent is pasture and range, 15 percent is cropland, 15 percent is woodland, and 5 percent is federal land and water areas. Growing rice and grain sorghum and raising beef cattle are the principal farming enterprises.

Harris County is in the Coast Prairie and East Texas Timberlands Land Resource Areas. The soils in the Coast Prairie Area formed under grasses and are dominantly dark colored, loamy, and clayey. The soils in the East Texas Timberlands Area formed under forest vegetation and are dominantly light colored, sandy, and loamy. Slope is the main management concern on the soils of this survey area. The nearly level soils are often seasonally wet, and adequate drainage outlets are needed. The other soils are susceptible to sheet and gully erosion if they are not protected.

## General Nature of the County

The history, industry, transportation, natural resources, and climate of the county are briefly described in this section.

### History

Harris County was established by an act of the Texas Legislature in 1836. It was named for John R. Harris, who settled at the junction of Buffalo Bayou and Brays Bayou in 1824. He established the town of Harrisburg, site of the first county seat. Houston was founded on August 30, 1836, and served as the capital of the Republic of Texas from 1837 to 1839. The county seat was moved from Harrisburg to Houston in 1836. Harrisburg is now part of Houston.

The first railroad in Texas operated out of Houston, and one of the first newspapers in Texas was published by Gail Borden in Harrisburg. Oil was discovered in Harris County in 1904. The Port of Houston became a deep water port with the arrival of the first ocean-going ship, the S. S. Satilla, in 1915.

### Industry

The industrial complex of Harris County is the largest in the Southwest. It includes manufacturing, marketing, merchandising, banking, housing, agribusiness, and science-based industries.

More than 2,600 manufacturing firms operate in Harris County. They employ 20 percent of the nonagricultural workers. Oil refining is Harris County's chief industry. About 20 major oil companies have headquarters in Houston. The county is also an important source of natural gas. A large part of the nation's petrochemicals (chemicals from crude oil and natural gas) are refined in the county.

The housing industry has expanded extensively in recent years to keep pace with population growth. Residential areas have developed around downtown Houston. Most of the county's residential units are single family homes. But since the 1950's, a large number of townhouses and high-rise apartment buildings have been built in several parts of the county.

The county is generally flat and fertile. Rice, grain sorghum, corn, cotton, forage, pasture, timber, and cattle are important agricultural products. In addition, Harris County is the nation's leading producer of agricultural chemicals, fertilizers, and insecticides. Emphasis in the county is on marketing and distribution of agricultural products; soil conservation; forage crop production; and breeding, feeding, and caring for livestock. More than 50 percent of the export tonnage of the Port of Houston is agricultural commodities.

The Lyndon B. Johnson Space Center is located in the southeastern part of Harris County, about 22 miles from downtown Houston. This complex was constructed in 1962 on a 1,640 acre site.

### Transportation

Interstate Highway 10 and Interstate Highway 45 meet in Houston, and in addition to a freeway system, Harris County has an excellent network of state and farm-to-market highways.

The Port of Houston, which in 1972 moved more than 69 million tons of cargo, is the third largest seaport in the United States in total tonnage, according to official statistics of the U.S. Corps of Engineers. The Houston Ship Channel, a 50-mile inland waterway, connects Houston with the sea lanes of the world. Most of the channel has a minimum width of 400 feet and a depth of 40 feet.

More than 100 steamship lines offer regular service between the Port of Houston and some 250 ports of the world. E very year more than 4,000 ships call at Houston, which has more than 100 wharves in operation.

Six major rail systems operate 14 lines of mainline track radiating from the City of Houston, and two switching lines serve the industrial areas and the Port of Houston.

### Natural Resources

Harris County has abundant supplies of minerals, timber, farming soil, sea water, and fresh water. Oil and gas furnish hydrocarbon compounds for refineries and chemical-petrochemical industries. Forest products from Harris County and surrounding counties support lumbering, plywood production, furniture fabrication, and paper milling. Salt and lime are also produced in the county.

The southeastern part of Harris County joins Galveston Bay for an abundant supply of sea water. The county is located atop a great underground water reservoir. A recent study indicates that the water in storage in the underground aquifer is sufficient for 250 years at a withdrawal rate of 600 million gallons daily. A dam on the San Jacinto River forms Lake Houston, which supplies Houston with 130 million gallons of surface water per day.

### Climate

The climate of Harris County is predominantly marine. The terrain includes numerous small streams and bayous which, together with the nearness to Galveston Bay, favor the development of fogs. Prevailing winds are from the southeast and south, except in January when frequent high pressure areas bring invasions of polar air and prevailing northerly winds.

Temperatures are moderated by the influence of winds from the Gulf, which results in mild winters and relatively cool summer nights. Another effect of the nearness of the Gulf is abundant rainfall, except for rare extended dry periods. Polar air penetrates the area frequently enough to provide stimulating variability in the weather. Table 1 gives data on temperature and precipitation.

The average number of days with minimum temperatures of 32 degrees F. or lower is only about 7 per year at Houston and 15 at the airport. Most freezing temperatures last only a few hours because they are usually accompanied by clear skies.

Monthly rainfall is evenly distributed throughout the year. Annual rainfall has varied from 72.86 inches in 1900 to 17.66 inches in 1917. About 75 percent of the years have total precipitation between 30 and 60 inches. Monthly precipitation has ranged from 17.64 inches to only a trace. Because thundershowers are the main source of rainfall, precipitation may vary substantially in different sections of Houston on a day-to-day basis.

About one-fourth of the days each year are clear. October has the most clear days. Cloudy days are relatively frequent from November to May and partly cloudy days are more frequent from June through September. Sunshine averages near 60 percent of the possible amount for the year ranging from 46 percent in winter to 69 percent in summer. Snow is rare. However, in an occasional year several inches will fall in January or February.

Heavy fog occurs on an average of 16 days a year, and light fog occurs about 62 days a year.

Destructive windstorms are fairly infrequent, but both thundersqualls and tropical storms occasionally pass through the area.

The average date of the last temperature of 32 degrees F. or lower in spring is March 2. The average date of the first 32 degrees F. temperature in fall is November 28. The average period from the last 32 degrees F. temperature in spring to the first in fall is 271 days.

## How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are located, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes, the size of streams and the general pattern of drainage, the kinds of native plants or crops, and many facts about the soils. They (lug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has been changed very little by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a soil survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series commonly is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Atasco and Beaumont, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in characteristics.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Atasco fine sandy loam, 1 to 4 percent slopes, is a phase within the Atasco series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a named soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Some cannot be classified as soils and are called land types. The mapping units in Harris County are discussed in the section “Soil Maps for Detailed Planning.”

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested and their suitabilities and limitations (interpretations) are modified as necessary during the course of the survey, and new interpretations are added to meet local needs. This is done mainly through field observations of behavior of different kinds of soil for different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so it can be readily useful to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

# General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Harris County. A soil association is a landscape that has a distinctive pattern of soil in defined proportions. It typically consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association can occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to locate large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area or in planning engineering works, recreation facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting a site for a road or building or other structure, because the soils in any one association ordinarily differ in slope, depth, drainage, and other characteristics that affect their management.

The soil associations in this survey have been grouped into four general kinds of landscapes for broad interpretative purposes. Each of the broad groups and the included soil associations in each group are described in the following pages. The terms for texture used in the title for several of the associations apply to the texture of the surface layer. For example, in the title of association *1, clayey* and *loamy* refer to the texture of the surface layer.

Land area of the eight soil associations in Harris County makes up about 98 percent of the total acreage in the county. The rest is water area.

## Nearly Level, Clayey and Loamy, Prairie Soils

This group of associations makes up about 39 percent of the county. The major soils are in the Lake Charles, Bernard, Midland, and Beaumont series. These are nearly level soils on the prairie. They have a clayey or loamy surface layer and clayey underlying layers. The soils that have a clayey surface layer have deep wide cracks on the surface when they are dry. Water enters the soil rapidly through the cracks, but enters very slowly when the soil is wet and the cracks are sealed. The clayey underlying layer has a high shrink-swell potential. The soils in these associations are somewhat poorly drained to poorly drained, and they are very slowly permeable.

Most of the soils were in crop or pasture at one time, and some areas are still used for farming. Rice, corn, grain sorghum, and cotton are the principal cultivated crops. Bermudagrass and dallisgrass are the principal plants on improved pasture. Native pasture plants are andropogon and paspalum. Native pine and hardwood trees have encroached in some areas, especially along the major streams and drainageways.

A large acreage consists of metropolitan areas and surrounding rural areas where the population is increasing. Many of the soils are covered by buildings and other structures such as single- and multiple-unit dwellings, garages, sidewalks, patios, driveways, streets, schools, churches, shopping centers, office buildings, paved parking lots, and industrial complexes. Some areas have been cut, graded, and filled.

The soils in this group of associations have severe limitations for urban use. The greatest management concern is the high shrink-swell potential. Cracked ceilings, driveways, sidewalks, patios, buckled retaining walls, and shifting fences are common. The risk of corrosion of uncoated steel is high, and many pipes rust through within 2 to 4 years. The soils are not suitable for use as septic tank filter fields. Establishing of lawns and gardens is difficult because of the high clay content of these soils. Where exposed, the soils are sticky and muddy when wet.

### 1. Lake Charles-Bernard association

*Somewhat poorly drained, very slowly permeable, clayey and loamy soils*

This association consists of nearly level soils on upland prairies (fig. 1). It occupies about 24 percent of the county. Lake Charles soils make up about 31 percent of the association, Bernard soils 31 percent, and Edna, Beaumont, Vamont, Midland, and Addicks soils make up the rest.

Lake Charles soils are smooth in most places, but in undisturbed areas they have gilgai relief. They are in slightly lower positions on the landscape than the Bernard soils. Bernard soils are also smooth, but in some areas the surface is dotted with numerous pimple mounds.

Lake Charles soils have a surface layer that is about 36 inches thick. In the upper 22 inches it is very firm, neutral, black clay. In the lower 14 inches it is very firm, mildly alkaline, very dark gray clay. The next layer is about 16 inches thick and is very firm, mildly alkaline, dark gray clay that has intersecting slickensides. The layer below that, extending from a depth of 52 inches to 74 inches, is very firm, mildly alkaline, gray clay that has mottles of olive brown and yellowish brown.

Bernard soils have a friable, neutral, very dark gray clay loam surface layer that is about 6 inches thick. The layer below that is about 48 inches thick and consists of firm, neutral, very dark gray clay in the upper part and very firm, moderately alkaline, dark gray clay in the lower part. Below that is a layer of firm, moderately alkaline, gray clay that has distinct yellowish brown mottles. There are a few calcium carbonate concretions at a depth of about 54 inches.

Edna soils occur mainly as pimple mounds in close association with Bernard soils. Beaumont, Vamont, Midland, and Addicks soils are in positions on the landscape similar to those of Lake Charles soils.

Large areas of this association are covered by buildings and other urban structures. Some areas are idle or are being held for future development. Other areas are used for cultivated crops, native pasture, and improved pasture.

Generally, these soils are only slightly susceptible to water erosion. Most erosion is caused by water flowing from large, nearly level areas into drainageways.

### 2. Midland-Beaumont association

*Poorly drained, very slowly permeable, loamy and clayey soils*

This association consists of nearly level soils on upland prairies. It occupies about 15 percent of the county. Midland soils make up about 49 percent of the association, and Beaumont soils about 20 percent. Lake Charles, Vamont, Bernard, Edna, and Clodine soils make up the rest.

Midland soils are smooth, but pimple mounds are common in a few places. These soils are in slightly higher positions on the landscape than Beaumont soils. Beaumont soils are also smooth in most places, but in undisturbed areas they have gilgai relief.

Midland soils have a surface layer of firm, strongly acid, dark grayish brown silty clay loam about 7 inches thick. The next layer is firm, medium acid, gray silty clay about 13 inches thick. The layer below that, extending to a depth of 50 inches, is very firm, dark gray clay that is slightly acid and has slickensides in the upper part. It is neutral in the lower part. The next layer, extending to a depth of 72 inches, consists of very firm, moderately alkaline clay that is mottled gray, olive yellow, and brownish yellow.

Beaumont soils have a surface layer of very firm, very strongly acid, dark gray to gray clay about 21 inches thick. The surface layer grades gradually to a layer, about 38 inches thick, of very firm, strongly acid, gray clay that has intersecting slickensides. The layer below extends to a depth of about 73 inches. It consists of very firm, slightly acid, grayish brown clay that has mottles of light olive brown and strong brown.

Edna soils occur mainly as pimple mounds in close association with the Midland soils. Vamont soils are adjacent to Beaumont soils mainly in gently sloping areas leading to natural drainageways. The Lake Charles, Bernard, and Clodine soils are in positions on the landscape similar to those of Midland and Beaumont soils.

This association is used for cultivated crops, native pasture, and improved pasture. Some areas are covered by buildings and other urban structures. Generally, the soils are only slightly susceptible to water erosion.

## Nearly Level, Loamy, Prairie Soils

This group of associations makes up about 47 percent of the county. The major soils are Clodine, Addicks, Gessner, Wockley, Katy, and Aris soils. These are nearly level soils on prairies. They have a loamy surface layer and loamy or clayey underlying layers. They are somewhat poorly drained to poorly drained and are moderately permeable to very slowly permeable.

Most of the soils are in crops or pasture. The soils are used mainly for rice, improved pasture, and native pasture. In a few areas they are used for corn, grain sorghum, and vegetables. Improved pastures consist mainly of common bermudagrass, Coastal bermudagrass, and Pensacola bahiagrass, and native pastures consist of bluestem and panicum and some berry vines, myrtle bushes, and annual weeds. Pine and hardwood trees have encroached in some areas.

One of the associations in this group is made up of metropolitan areas and built-up rural areas. Many of the soils are covered by buildings and other structures such as single- and multiple-unit dwellings, garages, sidewalks, patios, driveways, streets, schools, churches, shopping centers, office buildings, paved parking lots, and industrial complexes.

The soils in this group of associations have some severe limitations for town and country development. The most severe are the poor drainage characteristics of the soils. Many areas lack adequate drainage outlets. In general, the soils have severe limitations for use as septic tank filter fields. If they are used for lawns and gardens, they need artificial drainage.

### 3. Clodine-Addicks-Gessner association

*Poorly drained, moderately permeable soils*

This association consists of nearly level, loamy soils on prairies (fig. 2). It occupies about 19 percent of the county. Clodine soils make up about 31 percent of the association, Addicks soils about 27 percent, and Gessner soils about 18 percent. Wockley, Katy, and Aris soils make up the rest.

The Clodine soils occur in smooth, nearly level areas and as pimple mounds in areas slightly above the Addicks soils. Addicks soils are smooth and nearly level in most places. The Gessner soils are in depressions.

The Clodine soils have a friable, dark gray loam surface layer about 12 inches thick that is neutral in the upper part and moderately alkaline in the lower part. The next layer is friable, moderately alkaline gray loam about 17 inches thick. The layer below that, extending to a depth of 72 inches, is friable, moderately alkaline, light brownish gray loam that has irregularly shaped, pitted calcium carbonate concretions.

The Addicks soils have a friable, neutral, black loam surface layer about 11 inches thick. The layer below that is friable, neutral, dark gray loam about 12 inches thick. The next layer is about 26 inches thick and consists of friable, moderately alkaline, light gray loam that is about 20 percent, by volume, visible calcium carbonate. The layer at a depth of 49 inches is firm, moderately alkaline, light gray loam that has distinct yellow and yellowish brown mottles and is about 5 percent visible calcium carbonate.

The Gessner soils have a surface layer of friable, slightly acid, dark grayish brown loam about 7 inches thick. The next layer is about 9 inches thick and consists of friable, slightly acid, grayish brown loam. It tongues into a layer of friable, neutral, dark gray loam, about 18 inches thick that is slightly more clayey. The layer below that is about 19 inches thick and consists of friable, moderately alkaline, light brownish gray loam. The layer below that, extending to a depth of 84 inches, is firm, moderately alkaline, light gray sandy clay loam that has distinct mottles of yellowish brown and brownish yellow.

The Wockley soils are in positions similar to those of the Clodine soils. The Katy and Aris soils are in positions similar to those of the Addicks soils.

A large acreage is covered by buildings and other urban structures. A few areas are idle. The rest of the association is used for cultivated crops, native pasture, and improved pasture.

The soils are only slightly susceptible to water erosion. Lack of adequate outlets for surface drainage is the major management concern.

### 4. Wockley-Gessner association

*Somewhat poorly drained and poorly drained, moderately slowly permeable and moderately permeable soils*

This association consists of nearly level loamy soils on prairies (fig. 4). It occupies about 15 percent of the county. Wockley soils make up about 55 percent of the association, and Gessner soils make up about 22 percent. Clodine, Addicks, Hockley, Katy, and Aris soils make up the rest.

The Wockley soils are in smooth, nearly level areas, but there are pimple mounds in a few places. Wockley soils generally are in slightly higher positions on the landscape than the Gessner soils. The Gessner soils are in nearly level areas and in slight depressions. Some of the depressions are circular.

The Wockley soils have a surface layer of friable, strongly acid, dark grayish brown fine sandy loam about 7 inches thick. The next layer is friable, medium acid, brown fine sandy loam about 15 inches thick. The layer below that is about 11 inches thick and consists of firm, strongly acid, brown sandy clay loam that has mottles of yellowish brown, red, and light brownish gray. The next layer extends to a depth of 60 inches; it is firm, medium acid, light brownish gray sandy clay loam that has mottles of yellowish brown and red. It is about 12 percent plinthite.

The Gessner soils have a surface layer of friable, slightly acid, dark grayish brown loam about 7 inches thick. The next layer is about 9 inches thick and consists of friable, slightly acid, grayish brown loam. It tongues into a layer of friable, neutral, dark gray loam about 18 inches thick that is slightly more clayey. The layer below that is about 19 inches thick and consists of friable, moderately alkaline, light brownish gray loam. The next layer extends to a depth of 84 inches and is firm, moderately alkaline, light gray sandy clay loam that has distinct mottles of yellowish brown and brownish yellow.

The Clodine, Addicks, Katy, and Aris soils are in positions similar to those of the Wockley soils. The Hockley soils are better drained and are in slightly higher positions on the landscape than either Wockley or Gessner soils.

Most of this association is used for cultivated crops, native pasture, and improved pasture. Some areas are forested, especially along the major streams, and some residential subdivisions have been built in the forested areas. In general, the soils are only slightly susceptible to water erosion.

**5. Katy-Aris association**

*Somewhat poorly drained and poorly drained, very slowly permeable soils*

This association consists of nearly level, loamy soils on prairies. It occupies about 13 percent of the county. Katy soils make up about 41 percent of the association, and Aris soils make up about 20 percent. Gessner, Clodine, Wockley, and Addicks soils make up the rest.

Katy soils and Aris soils are mostly in smooth places. The Katy soils are in slightly higher places on the landscape than the Aris soils. Aris soils are more poorly drained than the Katy soils.

The Katy soils have a friable, medium acid, dark grayish brown fine sandy loam surface layer about 10 inches thick. The next layer is friable, medium acid, brown fine sandy loam that extends to a depth of about 28 inches. The layer below that is prominently mottled gray, red, yellowish brown, and strong brown. It is very firm, slightly acid clay loam that extends to a depth below 65 inches.

The Aris soils have a friable, neutral, dark grayish brown fine sandy loam surface layer about 7 inches thick. The next layer is friable, slightly acid, grayish brown fine sandy loam that extends to a depth of 21 inches. The layer below that extends to a depth of 28 inches and is firm, medium acid, gray sandy clay loam that contains tongues and interfingers. The next layer below that extends to a depth of 46 inches and is very firm, strongly acid dark gray clay that has mottles of red and strong brown. The layer below that extends to a depth of 60 inches and is very firm, medium acid, gray clay; it grades to very firm, slightly acid, light gray clay loam.

The Gessner soils are in low lying depressions similar to those of the Aris soils. The Clodine, Wockley, and Addicks soils are in positions on the landscape similar to those of the Katy soils.

Most of this association is used for cultivated crops, native pasture, and improved pasture. This association is the main rice producing area in the county. A few areas are covered by buildings and other urban structures. The soils are only slightly susceptible to water erosion.

## Nearly Level to Gently Sloping, Loamy, Forested Soils

This group of associations makes up about 10 percent of the county. The major soils are Aldine, Ozan, Segno, and Hockley soils. These are nearly level to gently sloping soils on forested uplands. They have a loamy surface layer and loamy or clayey underlying layers. They are moderately well drained to poorly drained. They are moderately slowly permeable to very slowly permeable.

The associations in this group include the most heavily timbered areas in the county. The soils are used mainly for timber production, woodland grazing, and improved pasture. In some small areas they are used for cultivated crops and home gardens. Native vegetation is chiefly pine and hardwood trees, beaked panicum, and little bluestem. Improved pasture grasses are mainly common bermudagrass, Coastal bermudagrass, and Pensacola bahiagrass.

Some buildings and other urban structures have been constructed on a few of the associations in this group. There are only a few residential subdivisions, but the potential for development is good because of the trees.

The limitations for town-and-country development are slope, drainage, and permeability. A lack of roads make some areas inaccessible.

**6. Aldine-Ozan association**

*Somewhat poorly drained and poorly drained, very slowly permeable and slowly permeable soils*

This association consists of nearly level, loamy, forested soils. It occupies about 6 percent of the county. Aldine soils make up about 41 percent of the association, and Ozan soils make up about 26 percent. Atasco, Bissonnet, Wockley, and Hockley soils make up the rest.

The Aldine soils are in nearly level areas, but there are pimple mounds in places. The Aldine soils are in slightly higher positions on the landscape than the Ozan soils, which are in nearly level areas and in slight depressions. Some of the depressions are enclosed.

The Aldine soils have a surface layer of friable, medium acid, dark grayish brown very fine sandy loam about 5 inches thick. The next layer is friable, medium acid, grayish brown very fine sandy loam about 5 inches thick. It tongues into friable, very strongly acid, yellowish brown loam about 9 inches thick. The layer below that consists of about 11 inches of firm, very strongly acid, gray clay that has mottles of yellowish brown and red. The next layer, extending to a depth of 60 inches, is firm, slightly acid, light gray clay loam that is less mottled with depth.

The Ozan soils have a surface layer of friable, medium acid, dark grayish brown loam about 2 inches thick. The next layer is about 16 inches thick and consists of friable, strongly acid, light brownish gray loam that tongues into a slightly more clayey layer of friable, medium acid, light brownish gray loam about 33 inches thick. The layer below that extends to a depth of 65 inches and is friable, strongly acid, light brownish gray sandy clay loam that has mottles of red and yellowish brown.

The Bissonnet and Wockley soils are in positions similar to those of the Aldine soils. The Hockley soils are better drained and are in slightly higher positions than the Aldine soils. The Atasco soils and some of the Hockley soils are in gently sloping areas leading to natural drainageways.

Most of this association is used for timber production, woodland grazing, and improved pasture. A few areas are used for urban development, mainly residential subdivisions. In general, the soils are only slightly susceptible to water erosion.

**7. Segno-Hockley association**

*Moderately well drained, moderately slowly permeable soils*

This association consists of nearly level to gently sloping, loamy, forested soils on uplands. It occupies about 4 percent of the county. Segno soils make up about 34 percent of the association, and Hockley soils make up about 32 percent. Aldine, Atasco, Bissonnet, Boy, Kenney, Wockley, and Ozan soils make up the rest.

The Segno soils and Hockley soils are in similar positions on the landscape. They are nearly level and gently sloping soils, but there are pimple mounds on the surface in a few areas.

The Segno soils have a surface layer of friable, very strongly acid, dark grayish brown fine sandy loam about 5 inches thick. The next layer is friable, very strongly acid, pale brown fine sandy loam about 8 inches thick. The layer below that is about 12 inches thick and consists of friable, very strongly acid, yellowish brown sandy clay loam. Below that is a layer of friable, very strongly acid sandy clay loam that has brownish yellow and red mottles. This layer is about 15 percent plinthite. At a depth of 42 inches the mottles are gray, and the soil material becomes grayer with depth.

The Hockley soils have a surface layer of very friable, medium acid, very dark grayish brown, fine sandy loam about 5 inches thick. The layer below that is very friable, medium acid, dark grayish brown fine sandy loam about 18 inches thick. The next layer is about 27 inches thick and consists of friable, medium acid, yellowish brown sandy clay loam. It is about 15 percent ironstone pebbles. Below that, to a depth of 100 inches, is a layer of friable, slightly acid, sandy clay loam that is reticulately mottled red, yellowish brown, and gray. It is about 25 percent plinthite in the upper part and 15 percent in the lower part.

The Kenney soils are in positions similar to those of the Segno and Hockley soils. The Aldine, Bissonnet, Boy, and Wockley soils are in slightly lower positions on the landscape than the Segno and Hockley soils. The Ozan soils are in even lower positions, mainly they are in slight depressions. The Atasco soils are in gently sloping areas leading to natural drainageways.

Most of this association is used for timber production, woodland grazing, and improved pasture. A few areas are used for residential subdivisions and other urban uses. The soils are only slightly to moderately susceptible to water erosion.

## Nearly Level, Forested, Bottom Land Soils

This group of soils makes up about 2 percent of the county. The major soils are Nahatche, Voss, and Kaman soils. These are nearly level soils on forested bottom lands and flood plains along the major creeks, bayous, and rivers in the county. The soils have a sandy, loamy, or clayey surface layer and underlying layers. They are moderately well drained to poorly drained and are rapidly permeable to very slowly permeable.

The soils are used mainly for timber production, woodland grazing, pasture, and wildlife habitat. Native vegetation is chiefly pine, water oak, willow oak, elm, beech, cottonwood, sweetgum, cypress, palmetto, sedges, longleaf uniola, little bluestem, switchgrass, indiangrass, beaked panicum, switch cane, and annual weeds. Bermudagrass is the principal grass for improved pasture.

The soils have severe limitations for most urban uses. The major limitation is the hazard of flooding. Most areas are within the 100-year flood plain. A few sheltered areas are suitable for use as parks for picnicking or other kinds of recreation. In some areas where cover is lacking, the soils are subject to scouring.

### 8. Nahatche-Voss-Kaman association

*Moderately well drained to poorly drained, rapidly permeable to very slowly permeable, loamy, sandy, and clayey soils*

This association consists of nearly level, loamy, sandy, and clayey, forested soils on bottom lands. It occupies about 2 percent of the county. Nahatche soils make up about 27 percent of the association, Voss soils 22 percent, and Kaman soils 13 percent. Hatliff soils, Harris soils, Ijam soils, and small areas of soils on the adjacent upland make up the rest.

The Nahatche, Voss, and Kaman soils are in similar positions on the landscape. They are on flood plains along the major creeks, bayous, and rivers in the county.

The Nahatche soils have a surface layer of friable, medium acid, dark grayish brown loam about 5 inches thick. The surface layer is underlain by several layers of varying texture. The upper layers are friable, medium acid, grayish brown loam, and the lower layers are firm, moderately alkaline, gray clay loam that has light gray and brownish yellow mottles.

The Voss soils have a surface layer of loose, medium acid, very dark grayish brown sand about 5 inches thick. Below that is a layer, extending to a depth of 70 inches, of loose, light gray sand that is slightly acid in the upper 25 inches and neutral in the lower 40 inches.

The surface layer of the Kaman soils is about 39 inches thick. It is very firm, neutral, very dark gray clay in the upper part and very firm, mildly alkaline, black clay in the lower part. The layer below that is 13 inches thick and consists of very firm, mildly alkaline, dark gray clay that has slickensides. The next layer, extending to a depth of 70 inches is very firm, mildly alkaline, dark gray clay and has a few yellowish brown mottles and calcium carbonate concretions.

The Hatliff soils are in positions on the landscape similar to those of the Nahatche, Voss, and Kaman soils. Hatliff soils have loamy and sandy layers. The Harris soils are clayey coastal marshland and are subject to inundation by water at high tide. The Ijam soils consist of clayey sediment dredged or pumped from the floor of rivers, bayous, bays, or canals during the construction or maintenance of these waterways.

Most of this association is used for timber production, woodland grazing, pasture, and wildlife habitat. It is not suitable for urban developments.

The soils are subject to flooding and, in some areas where cover is lacking, to soil removal by scouring.

## Soil Maps for Detailed Planning

The kinds of soil (mapping units) shown on the detailed soil map at the back of this publication are described in this section. These descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production, in planning land use and developing soil resources, and in enhancing, protecting, and preserving the environment. More information for each soil is given in the section “Planning the Use and Management of the Soils.”

Preceding the name of each mapping unit is the symbol that identifies the unit on the detailed soil map. Each mapping unit description includes general facts about the soil and a brief description of the soil profile. The principal hazards and limitations are indicated, and the management concerns and practices for the major uses are discussed.

A mapping unit represents an area on the landscape and consists of a dominant soil or soils for which the unit is named. Most mapping units have one dominant soil, but some have two or more dominant soils. A mapping unit commonly includes small, scattered areas of other soils. The properties of some of these soils can differ substantially from those of the dominant soil and thus greatly influence the use of the dominant soil.

In most areas surveyed there is land that has little or no identifiable soil and supports no vegetation. This land, called miscellaneous land types, is delineated on the map and given descriptive names. Urban land is an example. Areas too small to be delineated are identified by a special symbol on the soil map.

The acreage and proportionate extent of each mapping unit are given in table 2, and additional information on each unit is given in interpretive tables in other sections (see “Summary of Tables”). Many of the terms used in describing soils are defined in the Glossary.

### Soil Descriptions

**Ad—Addicks loam.** This is a nearly level soil in broad areas on the upland prairies. The areas are slightly higher on the landscape than those of the adjacent or surrounding soils. The surface is plane to slightly convex. The slope ranges from 0 to 1 percent but averages about 0.3 percent. Areas of this soil average several hundred acres in size, and some areas are as large as several thousand acres.

The surface layer is friable, neutral, black loam about 11 inches thick. The layer below that is friable, neutral, dark gray loam about 12 inches thick. The next layer is about 26 inches thick and consists of friable, moderately alkaline, light gray loam that is about 20 percent, by volume, visible calcium carbonate. Below that is a layer of firm, moderately alkaline, light gray loam that has distinct yellow and yellowish brown mottles and is about 5 percent visible calcium carbonate.

Included with this soil in mapping are small areas of Clodine, Bernard, Midland, and Gessner soils. Also included are a few areas of a soil that is similar to Addicks loam but is calcareous at the surface. A few areas are recently built-up urban land.

This soil is used primarily for rice, improved pasture, and native pasture. A few small areas are used for corn, grain sorghum, and vegetables. The native vegetation consists of bluestem and panicum and some greenbrier and annual weeds. Improved pasture grasses are common bermudagrass and Coastal bermudagrass. Pine and hardwoods have encroached in some areas.

This soil is poorly drained. It is saturated with water for short periods (luring the year. Surface runoff is slow, internal drainage is slow; and permeability is moderate. The available water capacity is high.

Drainage is the dominant concern in crop management. Proper fertilization and surface drainage increase crop and pasture production. Capability unit IIIw-1; rice group 2; pasture and hayland group

7C; Loamy Prairie range site; woodland suitability group 2w9; Tight Sandy Loam woodland grazing group.

**Ak—Addicks-Urban land complex**. This is a nearly level complex in urban areas and in the surrounding rural areas where the population is increasing. Encroachment of trees has occurred in some areas. The older urban areas are generally wooded, as a result of tree planting to provide shade. The areas of this mapping unit are irregular in shape and generally range in size from 30 to 850 acres. A few areas are larger than a thousand acres. The boundaries commonly coincide with the outer limits of subdivisions and other built-up areas. The surface is plane to slightly convex. The slope ranges from 0 to 1 percent and averages about 0.3 percent.

Addicks loam makes up 20 to 85 percent of the complex, Urban land 10 to 60 percent, and other soils 5 to 20 percent. The areas are so intricately mixed that it was not practical to separate them at the mapping scale for this survey.

The Addicks soil has a surface layer of friable, neutral, black loam about 11 inches thick. The layer below that is friable, neutral, dark gray loam about 12 inches thick. The next layer is about 26 inches thick and consists of friable, moderately alkaline, light gray loam that is about 20 percent, by volume, visible calcium carbonate. The layer at a depth of about 49 inches is firm, moderately alkaline, light gray loam that has distinct yellow and yellowish brown mottles and is about 5 percent visible calcium carbonate.

Urban land consists of soils that support buildings and other urban structures that have covered or altered the soils so that classification is not practical. Typical structures are single- and multiple- unit dwellings, streets, schools, churches, parking lots, office buildings, and shopping centers less than 40 acres in size. In places Urban land consists of small areas of Addicks loam that has been altered by cutting, filling, and grading. Fill material has altered the soil in places. In some areas the entire profile is covered with 6 to 24 inches of fill material. Soils in the older areas that are drained by road ditches show less evidence of alteration.

Included with this unit in mapping are a few areas of Clodine, Gessner, Bernard, and Midland soils. These soils are unaltered in places.

This mapping unit has moderate to severe limitations for urban development. Poor drainage is the greatest limitation. There are no limitations for landscaping or for gardening. Chlorosis is common in areas where cuts have been made. Most of the acreage was formerly in cropland or native pasture.

**Am—Aldine very fine sandy loam**. This is a nearly level soil in broad, oblong and oval, wooded areas. The surface is plane to slightly convex. The slope is 0 to 1 percent, but averages about 0.6 percent. Areas of this soil average 200 acres, but some are several hundred acres in size.

The surface layer is friable, medium acid, dark grayish brown very fine sandy loam about 5 inches thick. The layer below that is friable, medium acid, grayish brown very fine sandy loam about 5 inches thick. It tongues into a layer of friable, very strongly acid, yellowish brown loam about 9 inches thick. The next layer, about 11 inches thick, is firm, very strongly acid, gray clay that has mottles of yellowish brown and red. Below that, extending to a depth of 60 inches, is a layer of firm, slightly acid, light gray clay loam that is less mottled with depth.

Included in some mapped areas of this soil are small areas of Atasco, Bissonnet, Aris, Hockley, Segno, and Ozan soils. These soils make up less than 10 percent of any mapped area. Low, sandy, circular mounds are common in a few places. These rise 6 to 30 inches above the surface and are 15 to 50 feet in diameter.

This Aldine soil is used mainly for timber and woodland. The native vegetation is chiefly pine, hardwoods, sedge, beaked panicum, longleaf uniola, and little bluestem. Some small open or cleared areas are used as pasture or home gardens.

This soil is somewhat poorly drained. Surface runoff is slow, and permeability is very slow. The available water capacity is high. This soil is saturated at a depth of 20 to 30 inches during cool months and in periods of excessive rainfall.

Cultivated areas of this soil are difficult to manage. Fertilizer, lime, and drainage systems are beneficial to pasture and row crops. Capability unit IIIw-1; rice group 2; pasture and hayland group 8A; woodland suitability group 2w9; Flatwoods woodland grazing group.

**An—Aldine-Urban land complex**. This is a nearly level to gently sloping complex in metropolitan areas and in rural areas where the population is increasing. This mapping unit is of minor extent. Areas are irregular in shape and generally range from 30 to 250 acres in size. One area, however, covers 1,200 acres. Boundaries commonly coincide with the outer limits of subdivisions and built-up areas. The slope is mainly 0 to 2 percent but ranges to 3 percent. In a few places along drainageways the slope is 5 percent. Native pine and hardwoods are common in most areas.

The Aldine soil makes up 25 to 75 percent of this complex, Urban land 10 to 70 percent, and other soils 5 to 20 percent. The areas are so intricately mixed that it was not feasible to separate them at the mapping scale for this survey.

The surface layer of the Aldine soil is friable, medium acid, dark grayish brown very fine sandy loam about 5 inches thick. The layer below that is friable, medium acid, grayish brown very fine sandy loam about 5 inches thick. It tongues into a layer of friable, very strongly acid, yellowish brown loam about 9 inches thick. The next layer, about 11 inches thick, is firm, very strongly acid, gray clay that has mottles of yellowish brown and red. Below that, extending to a depth of 60 inches, is a layer of firm, slightly acid, light gray clay loam that has less mottles with depth.

Urban land consists of soils that have been altered or obscured by buildings and other urban structures, making their classification impractical. Typical structures are single- multiple-unit dwellings, garages, sidewalks, patios, driveways, streets, schools, churches, shopping centers, office buildings, paved parking lots, and industrial parks. Included with Urban land in mapping are small areas of the Aldine soil that have been altered by cutting, filling, and grading. In places, 6 to 24 inches of fill material has been added to improve drainage.

Included with this unit in mapping are a few areas of Atasco, Bissonnet, Aris, Hockley, Segno, Vamont, and Ozan soils. These soils are unaltered in places.

This mapping unit has moderate to severe limitations for urban development. It has severe limitations for use as septic tank filter fields because the clayey subsoil is very slowly permeable and has a high shrink-swell potential and a high corrosion potential. The areas were once in timber, so homeowners may have problems with tree stumps and roots.

**Ap—Aris fine sandy loam**. This is a nearly level soil in broad areas on the coastal prairie. The areas generally are several hundred acres in size and slightly lower on the landscape than those of adjacent or surrounding soils. The surface is plane to slightly concave. The slope averages about 0.2 percent.

The surface layer is friable, neutral, dark grayish brown fine sandy loam about 7 inches thick. The layer below that is friable, slightly acid, grayish brown fine sandy loam that extends to a depth of 21 inches. The next layer, extending to a depth of 28 inches, is firm, medium acid, gray sandy clay loam that contains tongues and interfingers. The layer below that, extends to a depth of 46 inches and is very firm, strongly acid, dark gray clay mottled with red and strong brown. The next layer is very firm, medium acid, gray clay that extends to a depth of 60 inches, where it grades to very firm, slightly acid, light gray clay loam.

Included with this soil in mapping are small areas of Katy, Gessner, Clodine, Ozan, Wockley, and Addicks soils. These soils make up less than 10 percent of the mapped acreage. There are low, sandy, circular mounds in a few undisturbed areas.

This soil is used mainly for rice, native pasture, and improved pasture. A few areas are used for corn and grain sorghum. The native vegetation is chiefly longleaf uniola, beaked panicum, little bluestem, indiangrass, greenbrier, berry vines, forbs, and annual weeds. Grasses for improved pastures mainly are common bermudagrass, Coastal bermudagrass, and Pensacola bahiagrass.

This soil is poorly drained. Surface runoff and internal drainage are slow. Permeability is very slow. A perched water table is above the tongued layer in the cool months or in periods of excess rainfall. The available water capacity is medium.

Poor drainage is the main limitation. Fertilizer, lime, and drainage systems are beneficial to crops and pasture. Capability unit IIIw-1; rice group 2; pasture and hayland group 8E; Loamy Prairie range site; woodland suitability group 2w8; Flatwoods woodland grazing group.

**Ar—Aris-Lessner complex.** This is a nearly level complex in large, irregular areas that are 100 to 1,000 acres in size. The complex consists of 30 to 50 percent Aris soil, 20 to 330 percent Gessner soil, and 20 to 30 percent other soils. The Aris soil is nearly level and slightly higher on the landscape than adjacent soils. The Gessner soil is in depressions that generally are either long, narrow meanders or circular in shape. The soils in this complex are so intricately mixed that separation was not feasible at the mapping scale for this survey. Furthermore, in leveling some areas for farming, part of the surface layer of the Aris soil has been distributed over the lower lying Gessner soil.

The Aris soil has a surface layer of friable, neutral, dark grayish brown fine sandy loam about 7 inches thick. The layer below that is friable, slightly acid, grayish brown fine sandy loam that extends to a depth of 21 inches. The next layer, extending to a depth of 28 inches, is firm, medium acid, gray sandy clay loam that tongues and interfingers. The layer below that extends to a depth of 46 inches and is very firm, strongly acid, dark gray clay mottled with red and strong brown. The next layer is very firm, medium acid, gray clay that extends to a depth of 60 inches, where it grades to very firm, slightly acid, light gray clay loam.

The Gessner soil has a surface layer of friable, slightly acid, dark grayish brown loam about 7 inches thick. The layer below that is about 9 inches thick and is friable, slightly acid, grayish brown loam. It tongues into the next layer, which is friable, neutral, dark gray loam that is slightly more clayey. That layer extends to a depth of 34 inches. The layer below that is friable, moderately alkaline, light brownish gray loam about 19 inches thick. Below that, extending to a depth of 84 inches, is a layer of firm, moderately alkaline, light gray sandy clay loam that has distinct mottles of yellowish brown and brownish yellow.

Included in mapping are small areas, less than 10 acres in size, of Clodine, Wockley, Ozan, and Katy soils.

The soils making up this complex are used mainly for rice, native pasture, and improved pasture. The native vegetation is chiefly andropogons, panicums, paspalums, and annual weeds. Grasses for improved pasture are mainly common bermudagrass, Coastal bermudagrass, and Pensacola bahiagrass.

The soils are poorly drained and are saturated with water part of the year. Excess water ponds on the Gessner soil and for long periods. Permeability is moderate to very slow. The available water capacity is medium.

Poor drainage is the main management concern. Drainage, land smoothing, and fertilization are beneficial practices for crops and pasture. Capability unit IIIw-1; rice group 2; pasture and hayland group 8E; Loamy Prairie range site, Aris soil, and Lowland range site, Gessner soil; woodland suitability group 2w8; Flatwoods woodland grazing group.

**As—Aris-Urban land complex**. This is a nearly level complex in broad, irregular areas that are 30 to 1,000 acres in size. Slopes range from 0 to 1 percent but average about 0.3 percent. Wooded areas are generally the result of encroachment or of the planting of trees during urban development.

The Aris soil makes up 20 to 75 percent of the complex; Urban land 10 to 75 percent, and other soils 5 to 20 percent. The areas are so intricately mixed that separation was not practical at the mapping scale for this survey.

The surface layer of the Aris soil is friable, neutral, dark grayish brown fine sandy loam about 7 inches thick. The layer below that is friable, slightly acid, grayish brown fine sandy loam that extends to a depth of 21 inches. The next layer, extending to a depth of 28 inches, is firm, medium acid, gray sandy clay loam that has tongues and interfingers. The layer below that extends to a depth of 46 inches and is very firm, strongly acid, dark gray clay that has mottles of red and strong brown. The next layer is very firm, medium acid, gray clay that extends to a depth of 60 inches, where it grades to very firm, slightly acid, light gray clay loam.

Urban land consists of soils that have been covered or altered by buildings and other urban structures, making their classification impractical. Typical structures are single- and multiple-unit dwellings, streets, schools, churches, parking lots, office buildings, and shopping centers less than 40 acres in size. Some areas of Urban land are Aris soil that has been altered by cutting, filling, and grading. Areas that have fill material on top of the natural soil are common.

Included with this complex in mapping are small areas of Katy, Gessner, Clodine, and Addicks soils. There are low, sandy, circular mounds in some undisturbed areas.

This mapping unit has moderate to severe limitations for urban development but is well suited to lawns and gardens. Poor drainage and the clayey underlying layer are the main limitations.

**AtB—Atasco fine sandy loam, 1 to 4 percent slopes.** This is a gently sloping soil in oblong and oval areas along ridges and natural drainageways. The areas average about 150 acres, but some are several hundred acres in size. The surface is plane to convex. The slope ranges from 1 to 4 percent but averages about 2.5 percent.

The surface layer is friable, strongly acid, dark grayish brown fine sandy loam about 5 inches thick. The layer below that is friable, medium acid, light yellowish brown fine sandy loam about 11 inches thick. The next layer is about 3 inches thick and is friable, very strongly acid, brownish yellow sandy clay loam that has tongues of fine sandy loam. The layer below that extends to a depth of 60 inches and is firm, very strongly acid, yellowish brown clay in the upper part and firm, strongly acid, gray clay that has mottles of yellowish brown and red in the lower part.

Included with this soil in mapping are small areas of Aldine, Bissonnet, Hockley, Wockley, Segno, and Ozan soils. Also included are sloping soils that have been eroded by water; these are in small areas along drainageways. Sandy, circular mounds are on the surface in a few places. The included soils make up less than 15 percent of any mapped area.

This soil is used mainly for timber production and woodland. The native vegetation is chiefly pine, hardwoods, sedges, beaked panicum, and little bluestem. Some small open areas are used for pasture.

This soil is moderately well drained. Surface runoff is medium, and permeability is very slow. The available water capacity is high. The lower part of the soil is saturated for 2 to 4 months in wet seasons. The hazard of erosion is slight to moderate.

In cultivated areas, contour farming, terracing, and protected outlets for terraces are needed to help protect this soil from erosion. Fertilizer and lime are beneficial to crops and pasture. Capability unit IIe-1; pasture and hayland group 8A; woodland suitability group 2w8; Sandy loam woodland grazing group.

**Ba—Beaumont clay.** This is a nearly level soil on the coastal prairie. Areas of this soil are broad and irregular in shape and are 30 to several hundred acres in size. The slope ranges from 0 to 1 percent but average 0.3 percent. The surface is covered by a mulch of fine, discrete, very hard aggregates. Gilgai microrelief is distinct in undisturbed areas but is not apparent in cultivated fields.

In the center of microdepressions, the surface layer is very firm, very strongly acid, dark gray to gray clay about 21 inches thick. The surface layer grades gradually to a layer, about 38 inches thick, of very firm, strongly acid, gray clay that has intersecting slickensides. The next layer, extending to a depth of about 73 inches, is very firm, slightly acid, grayish brown clay mottled with light olive brown and strong brown.

Included with this soil in mapping are small areas of Lake Charles, Bernard, Midland, Addicks, and Vamont soils. These soils make up less than 5 percent of most of the areas.

Crops grow moderately well on this soil. Most of the acreage is cultivated, and the rest is used for improved pasture or native grazing. Rice is the main crop; grain sorghum is a minor crop. Bermudagrass and dallisgrass are the main plants for improved pasture. Native grasses are mainly andropogon, paspalum, and panicum. In a few places, pine and hardwoods have encroached. The trees grow well, but few are used for commercial timber. The areas that have trees are used mostly for subdivisions, house sites, and shopping centers.

This soil is poorly drained. Surface runoff and internal drainage are very slow. Permeability is very slow, and the available water capacity is high. In some areas the surface cracks when the soil is dry. Rainwater enters the cracks rapidly but then moves very slowly into the soil.

Excess surface water and poor soil tilth are the main management concerns. Farming destroys the surface structure of the soil, and the soil becomes massive. Fertilization and drainage are beneficial for pasture and crops. Capability unit IIIw-2; rice group 1; pasture and hayland group 7A; Blackland range site; woodland suitability group 2w9; Blackland woodland grazing group.

**Bc—Beaumont-Urban land complex**. This is a nearly level complex in broad metropolitan areas and surrounding rural areas. It is of minor extent. The areas are irregular in shape and range from 30 to 500 acres in size. A few areas are larger than 1,000 acres. The slope ranges from 0 to 1 percent but averages about 0.3 percent.

The Beaumont soil makes up 15 to 80 percent of this mapping unit; Urban land 10 to 70 percent; and other soils 5 to 20 percent. The areas are so intricately mixed that it was not feasible to separate them at the mapping scale for this survey.

Beaumont soils have a surface layer of very firm, very strongly acid, dark gray to gray clay about 21 inches thick. The surface layer grades gradually to a layer, about 38 inches thick, of very firm, strongly acid, gray clay that has intersecting slickensides. The next layer extends to a depth of 73 inches and is very firm, slightly acid, grayish brown clay that has mottles of light olive brown and strong brown.

Urban land consists of soils that have been altered or obscured by buildings or other urban structures making classification of the soils impractical. Typical structures are single- and multiple-unit dwellings, garages, sidewalks, patios, driveways, streets, schools, churches, shopping centers less than 40 acres in size, office buildings, paved parking lots, and industrial sites. Areas of the Beaumont soil and of other soils that have been altered by cutting, grading, and filling, make up some Urban land. In some areas the soil has not been altered but it is covered by 6 to 24 inches of clayey fill material.

Included in mapping are areas of Lake Charles, Bernard, Midland, and Vamont soils. These soils have been altered in some places.

This mapping unit has severe limitations for urban development. The main limitation is the high shrink-swell potential. Shrinking and swelling have caused driveways, sidewalks, patios, and ceilings to crack, rock retaining walls to buckle, and fences to shift. Corrosivity is high and many uncoated steel pipes are rusted through within 2 to 4 years. Landscaping and gardening are difficult on these soils. Hardwood trees have been planted or have encroached in most areas; pine have encroached in a few areas. Uncovered areas are muddy and sticky when wet, and roads need to be paved or shelled. These soils are not suitable for use as septic tank filter fields.

**Bd—Bernard clay loam**. This is a nearly level soil in broad, irregularly shaped areas that average 500 acres in size but range from 20 to 3,000 acres. The slope ranges from 0 to 1 percent but averages less than 0.5 percent.

The surface layer is friable, neutral, very dark gray clay loam about 6 inches thick. The layer below that is 48 inches thick and consists of firm, neutral, very dark gray clay in the upper part and very firm, moderately alkaline, dark gray clay in the lower part. The next layer is firm, moderately alkaline, gray clay that has distinct yellowish brown mottles and a few calcium carbonate concretions.

Included with this soil in mapping are a few areas of other soils, mainly Lake Charles and Addicks soils, and also Beaumont, Clodine, and Midland soils. These soils make up less than 15 percent of any mapped area.

This soil is used mainly for row crops, improved pasture, and native pasture. A few acres are used for rice. Principal row crops are cotton, corn, and grain sorghum. Improved pastures of bermudagrass and dallisgrass are common. The native vegetation is tall prairie grasses, including andropogons and paspalums.

This soil is somewhat poorly drained. Surface runoff is very slow. Internal drainage and permeability are very slow. The available water capacity is high.

This is a productive soil because its moisture holding capacity is favorable and its capacity to hold plant nutrients is favorable. In cultivated areas, fertilizer and crop residue management are needed to help maintain soil tilth and high production. Capability unit IIw-1; rice group 1; pasture and hayland group 7C; Blackland range site; woodland suitability group 2w9; Blackland woodland grazing group.

**Be—Bernard-Edna complex**. This complex is in broad areas on the coastal prairie. The areas average 250 acres, but some are several hundred acres in size. The surface is plane, concave, and convex and is characterized by many distinctive knolls and pimple mounds. The slope ranges from 0 to 2 percent but averages 0.8 percent.

Bernard clay loam and Edna fine sandy loam are the major soils. The Bernard soil makes up about 55 percent of the complex. It is generally in slightly concave depressions and on the flats between the knolls and pimple mounds of the Edna soil. The slope is from 0 to 1 percent. The Edna soil makes up about 30 percent of the complex. It is mainly on convex knolls, ridges, and circular pimple mounds. The slope is 1 to 2 percent. The rest of the complex is made up of closely associated soils, such as Addicks, Lake Charles, and Clodine soils. The soils in this complex are so intricately mixed that it was not feasible to separate them at the mapping scale for this survey. All the soils are generally used and managed alike.

The surface layer of the Bernard soil is friable, neutral, very dark gray clay loam about 6 inches thick. The layer below that is 48 inches thick and consists of firm, neutral, very dark gray clay in the upper part and very firm, moderately alkaline, dark gray clay in the lower part. The next layer is firm, moderately alkaline, gray clay that has distinct yellowish brown mottles and a few calcium carbonate concretions.

The Edna soil is similar to that described as representative of the Edna series, but its surface layer is slightly thicker. The surface layer is friable, neutral, dark grayish brown fine sandy loam about 10 inches thick. It is underlain abruptly by a layer of very firm, moderately alkaline clay, about 34 inches thick, that is gray in the upper part and olive gray in the lower part. The layer below that is firm, moderately alkaline, gray sandy clay loam that has mottles of yellowish brown.

Most areas of this complex are in native pasture of beaked panicum, paspalum, sporobolus, and andropogon. Cultivated areas require land leveling to smooth the moundy areas.

The soils in this complex are somewhat poorly drained to poorly drained. They are generally saturated in winter and in early spring. Internal drainage and permeability are very slow. The available water capacity is medium to high.

The moundy surface and poor drainage are the major concerns of management. Drainage, fertilization, and land leveling are needed for cultivated crops. Capability unit IIw-1; rice group 1; pasture and hayland group 7C; Blackland range site, Bernard soil, and Claypan Prairie range site, Edna soil; woodland suitability group 2w9; Blackland woodland grazing group.

**Bg—Bernard-Urban land complex**. This is a nearly level complex in broad metropolitan areas and rural areas where the population is increasing. The areas are 40 to several hundred acres in size. The slope is 0 to 1 percent but averages 0.5 percent.

The Bernard soil makes up 30 to 80 percent of this complex, and Urban land 10 to 70 percent. Other soils, mainly Lake Charles, Addicks, Edna, and Clodine soils, make up 10 to 20 percent. The areas are so intricately mixed that it was not practical to separate them at the mapping scale for this survey. Pimple mounds are common in a few undisturbed areas of Edna and Clodine soils.

The surface layer of the Bernard soil is friable, neutral, very dark gray clay loam about 6 inches thick. The layer below that is about 48 inches thick and consists of firm, neutral, very dark gray clay in the upper part and very firm, moderately alkaline, dark gray clay in the lower part. The next layer is firm, moderately alkaline, gray clay that has distinct yellowish brown mottles and a few calcium carbonate concretions.

Urban land consists of soils that have been altered or covered by buildings and other urban structures, making classification impractical. Typical structures are single-and multiple-unit dwellings, garages, sidewalks, driveways, streets, schools, and churches. Also there are shopping centers that are less than 40 acres in size, a few single- and multiple-story office buildings, paved parking lots, and industrial sites. Open spaces within developed areas are commonly covered by 4 to 18 inches of clayey fill material. Such areas generally are adjacent to major thoroughfares, recessed streets, and larger commercial buildings. There are some areas that are less than 10 percent covered by buildings and other structures.

In general, this mapping unit has severe limitations for urban development. The major limitation is the high shrink-swell potential. Shrinking and swelling have caused driveways, patios, brick walls and ceilings to crack, sidewalks and streets to buckle, and fences to shift. Corrosivity to uncoated steel pipes is high. Landscaping is difficult, particularly in areas that have been compacted by machinery. Where exposed, the soils are sticky when wet. The soils are not suitable for use as septic tank filter fields.

**Bn—Bissonnet very fine sandy loam.** This is a nearly level soil in irregularly shaped, timbered areas that have smooth boundaries. The areas average 100 acres in size but some are as large as 500 acres. The surface is plane to slightly convex. The slope is 0 to 1 percent but averages 0.5 percent.

The surface layer is friable, very strongly acid, dark grayish brown very fine sandy loam about 6 inches thick. In a few places, where there are low circular pimple mounds on the surface, the surface layer is slightly thicker. The next layer is friable, very strongly acid, brown and pale brown very fine sandy loam about 22 inches thick. It tongues into the upper part of a layer that is friable, very strongly acid, light brownish gray sandy clay loam. The layer below that, extending to a depth of 70 inches, is firm, very strongly acid, gray clay loam in the upper 10 inches and firm, mildly alkaline, light gray clay loam in the lower 28 inches.

Included with this soil in mapping are small areas of Aldine, Atasco, Hockley, Segno, Wockley, and Ozan soils. These soils make up less than 15 percent of any mapped area.

This soil is used mainly for timber production and woodland grazing. Native vegetation is chiefly pine, hardwoods, sedge, beaked panicum, and little bluestem. A few small open areas are used for pasture and cultivated crops.

This soil is somewhat poorly drained. Surface runoff is slow, and the erosion hazard is slight. The available water capacity is high, and permeability is slow. During some wet seasons this soil has a perched water table, and the lower layers are saturated for 1 to 4 months.

Fertilization, liming, and careful management are needed for crops and pasture. Capability unit IIIw-1; rice group 2; pastureland and hayland group 8A; woodland suitability group 2w8; Flatwoods woodland grazing group.

**Bo—Boy loamy fine sand.** This soil is nearly level to gently sloping in areas along low terraces of natural drainageways. The areas are oblong and irregular and average 150 acres, but some are 700 acres in size. The surface is plane to slightly depressed or concave. The slope ranges from 0 to 2 percent but averages about 1 percent.

The surface layer is very friable, slightly acid, dark gray loamy fine sand in the upper 5 inches and very friable, strongly acid, grayish brown fine sand in the lower 4 inches. The layer below that is loose, medium acid, fine sand and extends to a depth of 56 inches. It is light yellowish brown in the upper part and very pale brown in the lower part. The next layer, extending to a depth of 75 inches, is friable, very strongly acid, light brownish gray sandy clay loam that has mottles of strong brown and red and is about 10 percent plinthite.

Included with this soil in mapping are areas of other soils that make up less than 15 percent of any mapped area. These include small areas of Kenney soils, small areas of Ozan soils in slight depressions, Hockley or Segno soils that are slightly higher on the landscape, and Voss soils that are slightly lower on the landscape.

This soil is used mainly for timber and woodland grazing. Native vegetation is loblolly pine, shortleaf pine, sweetgum, and southern red oak and an understory of sweetbay, American beautyberry, greenbriar, longleaf uniola, bull nettle, little bluestem, and blackberry vine. A few cleared areas are planted to Coastal bermudagrass, Pensacola bahiagrass, and weeping lovegrass.

This soil is somewhat poorly drained. In wet seasons, the layer that has plinthite and the material just above it are saturated for 2 to 4 months. There is no runoff in some places, and it is very slow in others. Internal drainage and permeability are rapid above the layer that has plinthite. Below that, permeability is moderately slow. The available water capacity is low. Capability unit IIIw-3; pasture and hayland group 9C; woodland suitability group 2s2; Sandy woodland grazing group.

**Cd—Clodine loam.** This is a nearly level soil on broad, irregular areas, about 400 acres in size that are generally low on the landscape. Slopes are 0 to 1 percent but average 0.5 percent.

The surface layer is friable, dark gray loam about 12 inches thick. It is neutral in the upper part and moderately alkaline in the lower part. The layer below that is friable, moderately alkaline, gray loam about 17 inches thick. The next layer extends to a depth of 72 inches. It is friable, moderately alkaline, light brownish gray loam that has irregular, pitted calcium carbonate concretions.

Included with this soil in mapping are small areas of Addicks, Aris, Gessner, Midland, Edna, and Katy soils and small areas of saline soils. In some undisturbed areas there are low, circular, sandy mounds about 30 to 40 feet in diameter. These inclusions make up less than 15 percent of any mapped area.

This soil is used mainly for growing native pasture for cattle and for rice. Native grasses are mainly prairie grasses, such as andropogon, paspalum, and panicum. Myrtle bushes are common. Pine and oak forests have encroached in some areas.

This soil is poorly drained and is saturated for 3 to 6 months in winter and early in spring. Surface runoff is very slow, and internal drainage is slow. Permeability is moderate. The available water capacity is high.

Excess water on the surface makes this soil cold, often reducing stands of early crops. Drainage, fertilization, and crop residue are essential in maintaining the high productivity of this soil. Capability unit IIIw-1; rice group 2; pasture and hayland group 8E; Lowland range site; woodland suitability group 2w9; Flatwoods woodland grazing group.

**Ce—Clodine-Urban land complex**. This is a nearly level complex in broad, irregular areas that range from 20 to several hundred acres in size. The slope ranges from 0 to 1 percent but averages 0.6 percent. Pine and hardwoods have encroached in some areas, and in a few areas trees have been planted for shade.

Clodine soils make up 20 to 85 percent of this mapping unit; Urban land, 10 to 75 percent; and other soils, 5 to 20 percent. The soils are so intricately mixed that separation was not practical at the scale used in mapping.

The surface layer of the Clodine soil is friable, dark gray loam about 12 inches thick. It is neutral in the upper part and moderately alkaline in the lower part. The layer below that is friable, moderately alkaline, gray loam about 17 inches thick. The next layer is friable, moderately alkaline, light brownish gray loam that has irregular, pitted calcium carbonate concretions.

Urban land consists of soils that have been altered or covered by buildings and other urban structures making classification impractical. Typical structures are single-and multiple-unit dwellings, driveways, sidewalks, garages and patios, streets, schools, churches, parking lots, office buildings, and shopping centers of less than 40 acres in size. Included are areas of Clodine soils that have been altered by cutting, filling, and grading for development. Fill material commonly covers the Clodine soils.

This mapping unit has moderate to severe limitations for urban development. The main limitation is poor drainage. There are only a few limitations for landscaping and gardening, but chlorosis in plants is common.

**Ed—Edna fine sandy loam**. This is a nearly level soil on the prairie. The areas of this soil are irregular and generally small, but a few are several hundred acres in size. The slope is mainly 0 to 2 percent but averages 0.8 percent. In some undisturbed areas, the surface is covered with small circular pimple mounds. The mounds generally are leveled if the soil is cultivated.

The surface layer is friable, neutral, dark grayish brown fine sandy loam about 5 inches thick. It abruptly meets the layer below that, which is very firm, moderately alkaline clay about 36 inches thick. The clay is gray in the upper part and olive gray in the lower part. The next layer extends to a depth of 72 inches; it is firm, moderately alkaline, gray sandy clay loam that has mottles of yellowish brown.

Included with this soil in mapping are small areas of Addicks, Aris, Bernard, Clodine, Gessner, Katy, and Midland soils, which make up less than 15 percent of any mapped area. Also included are soils, mainly in areas of pimple mounds, that are similar to this Edna soil but that have a surface layer 10 to 18 inches thick.

This soil is used mainly for rice and native pasture. A few small areas are used for corn or grain sorghum. Native vegetation is mainly such prairie grasses as paspalum, panicum, and sporobolus.

This soil is poorly drained. Runoff and permeability are very slow. The soil is saturated for long periods in winter and early spring. The available water capacity is high.

Poor surface drainage and the droughtiness of the clayey subsoil are the main limitations. Fertilization and drainage are beneficial in crop and pasture production. Capability unit IIIw-1; rice group 2; pasture and hayland group 8A; Claypan Prairie range site; woodland suitability group 2w9; Tight Sandy Loam woodland grazing group.

**Ge—Gessner loam**. This is a nearly level soil in broad, irregular areas and in small, round depressions. It is lower on the landscape than adjacent soils. In places this soil is wet or ponded for long periods after heavy rains. Most of the water evaporates. Slopes are mainly less than 0.5 percent, but the range is 0 to 1 percent. The surface is plane to slightly concave. Mapped areas average 170 acres, but some are several hundred acres in size.

The surface layer is friable, slightly acid, dark grayish brown loam about 7 inches thick. The layer below that is about 9 inches thick and is friable, slightly acid, grayish brown loam. It tongues into the next layer, which is friable, neutral, dark gray loam, about 18 inches thick, that is slightly more clayey. The layer below that is about 19 inches thick and consists of friable, moderately alkaline, light brownish gray loam. The next layer, to a depth of 84 inches, is firm, moderately alkaline, light gray sandy clay loam that has distinct mottles of yellowish brown and brownish yellow.

Included with this soil in mapping are small areas of Addicks, Aris, Clodine, Katy, Ozan, and Wockley soils, which make up less than 15 percent of any mapped area.

This soil is used mainly for native pasture, improved pasture, and rice. Native vegetation is chiefly low panicum and paspalum, carpetgrass, berry vines, rushes, sedges, and weeds. Improved pasture grasses are chiefly common bermudagrass, Coastal bermudagrass, and Pensacola bahiagrass. In timbered areas, the vegetation is mainly water oak, willow oak, ash, ironwood, hickory, loblolly pine, palmetto, greenbrier, and longleaf uniola.

This soil is poorly drained and is generally saturated in wet periods. Surface runoff is very slow to ponded, and internal drainage is slow. Permeability is moderate, and the available water capacity is high.

Excess water on the surface and inadequate drainage are the major limitations. Fertilization, liming, and drainage are needed for pasture and row crops. Capability unit IVw-1; rice group 2; pasture and hayland group 8E; Lowland range site; woodland suitability group 3w9; Flatwoods woodland grazing group.

**Gs—Gessner complex.** This is a nearly level complex in broad, irregular areas that are about 400 acres in size. The slope is 0 to 1 percent. Pimple mounds and slight depressions between the mounds are characteristic of the areas.

Gessner soils make up 55 to 70 percent of this complex; Clodine soils, 15 to 20 percent; and other soils, 15 to 25 percent. The Gessner soils, and some Addicks soils, are on the flats and in the depressions between the mounds. Clodine soils are in the nearly level areas surrounding the mounds. The other soils, mainly Wockley, Katy, and Aris soils, generally are on the pimple mounds.

The surface layer of the Gessner soils is friable, slightly acid, dark grayish brown loam about 7 inches thick. The layer below that is about 9 inches thick and consists of friable, slightly acid, grayish brown loam. It tongues into the next layer, which is friable, neutral, dark gray loam, about 18 inches thick, that is slightly more clayey. The layer below that is about 19 inches thick and consists of friable, moderately alkaline, light brownish gray loam. The next layer, to a depth of 84 inches, is firm, moderately alkaline, light gray sandy clay loam that has distinct mottles of yellowish brown and brownish yellow.

This complex is used mainly for native pasture of beaked panicum, little bluestem, and Indiangrass. Land leveling is needed where the soils are used for rice. Pine and hardwoods have encroached in some areas.

This complex is poorly drained and is generally saturated in winter and early in spring. Surface runoff is very slow, and internal drainage is slow. Permeability is moderate. The available water capacity is high.

Excess water on the surface is the major limitation. Drainage, fertilization, and land leveling are needed for crops. Capability unit IVw-1; rice group 2; pasture and hayland group 8E; Lowland range site; woodland suitability group 3w9; Flatwoods woodland grazing group.

**Gu—Gessner-Urban land complex.** This mapping unit is in broad, nearly level areas and in depressions. It consists of built-up areas and areas where the population is increasing. The areas range from 15 to 180 acres, but a few are several hundred acres in size. Slopes are mainly 0 to 1 percent. Water stands on the surface in the depressions for long periods after rains. There are pimple mounds in a few areas. These are leveled in urban development. Water oak, willow oak, hackberry, sweetgum, and elm have encroached in some areas.

Gessner soils make up 20 to 80 percent of this unit; Urban land, 10 to 75 percent; and other soils, 10 to 20 percent. The areas making up this complex are so intricately mixed that separation was not practical at the scale use in mapping.

The surface layer of the Gessner soils is friable, slightly acid, dark grayish brown loam about 7 inches thick. The layer below that is about 9 inches thick and consists of friable, slightly acid, grayish brown loam. It tongues into the next layer, which is friable, neutral, dark gray loam, about 18 inches thick that is slightly more clayey. The layer below that is about 19 inches thick and consists of friable, moderately alkaline, light brownish gray loam. The next layer, to a depth of 84 inches, is firm, moderately alkaline, light gray sandy clay loam that has distinct mottles of yellowish brown and brownish yellow.

Urban land consists of soils that have been altered or covered by buildings or other urban structures and of other disturbed areas. Classifying these soils is not practical. Typical structures are single- and multiple-unit dwellings, garages, sidewalks, patios, driveways, streets, schools, churches, shopping centers, office buildings, pipe yards, refineries, chemical plants, railroads and paved parking lots. Other areas have been disturbed by cutting, filling, or grading. In some areas 6 to 24 inches of fill material covers the entire soil profile.

Included with this complex in mapping are mainly Addicks, Clodine, Katy, Aris, and Wockley soils.

Gessner soils have severe limitations for streets and low-cost roads and urban development in general and for use as septic tank filter fields. The main limitation is poor drainage. Water stands on the surface for long periods after rains, and the soil remains wet long after water on the surface has evaporated. The risk of corrosion to uncoated steel is high. Most areas are muddy and boggy when wet.

**Ha—Harris clay.** This is a level to nearly level soil on coastal marshlands. It is generally lowest on the landscape and in most areas is subject to inundation by high tide. The areas are oblong and crescent shaped and average about 35 acres in size. Slopes average 0.1 percent but range from 0 to 1 percent.

The surface layer is very firm, moderately alkaline, black clay about 20 inches thick. The layer below that is about 12 inches thick and consists of very firm, moderately alkaline, dark gray clay. The next layer is about 13 inches thick and consists of very firm, moderately alkaline, gray clay. Below that, to a depth of 64 inches, is a layer of very firm, moderately alkaline, gray clay that has calcium carbonate concretions.

Included with this soil in mapping are small areas of Beaumont, Kaman, Lake Charles, and Ijam soils. One or more of these soils make up less than 10 percent of any mapped area.

This soil is used mainly as wildlife habitat. Native vegetation is chiefly water-loving and salt-tolerant grasses and sedges, such as seashore saltgrass, common reed, and marshhay cordgrass.

This soil is very poorly drained. Surface runoff, internal drainage, and permeability are very slow. A permanent water table fluctuates between the surface and a depth of 50 inches. The available water capacity is low.

Salinity and poor surface drainage are the main limitations. Capability unit VIIw-1; Salt Marsh range site.

**Hf—Hatliff loam.** This is a nearly level soil on the flood plains in oblong areas that have smooth boundaries. The areas average 30 acres, but are up to 100 acres in size. In some places this soil is gently sloping. The average slope is 0.8 percent, but the range is 0 to 1 percent, and in some areas along old stream channels it is 0 to 2 percent. In places, channel scars or partly filled old stream channels dissect the surface.

The surface layer is friable, medium acid, dark brown loam in the upper 5 inches and friable, strongly acid, brown fine sandy loam in the lower 5 inches. The texture of the layers below that varies. The upper layers are very friable, strongly acid, yellowish brown fine sandy loam, and the lower, loose, neutral, very pale brown sand.

Included with this soil in mapping are small areas of soils that have a surface layer of fine sandy loam or loamy fine sand and small areas of Voss and Nahatche soils. These soils make up less than 5 percent of any mapped area.

This soil is used mainly for woodland grazing, timber and wildlife habitat. Native vegetation is chiefly loblolly pine, water oak, willow oak, red oak, sycamore, sweetgum, American beautyberry, wild grape, berry vines, yaupon, peppervine, longleaf uniola, beaked panicum, and switchgrass.

This soil is moderately well drained. Surface runoff is slow. Permeability is moderately rapid. It is generally flooded a few times each year. In most years it is saturated for a few days to a few weeks, mainly in winter and early in spring. The available water capacity is low.

This soil is subject to flooding and washing and to the deposition of new soil material. Capability unit VIw-1; pasture and hayland group 2A; woodland suitability group 2w8; Loamy Bottomland woodland grazing group.

**HoA—Hockley fine sandy loam, 0 to 1 percent slopes.** This is a nearly level soil in forested areas and in cleared areas along the northern boundary of the coastal prairie. The areas are generally irregular and about 150 acres in size. Slopes are slightly convex and average 0.5 percent.

The surface layer is very friable, medium acid, very dark grayish brown fine sandy loam about 5 inches thick. The layer below that is very friable, medium acid, dark grayish brown fine sandy loam about 18 inches thick. The next layer is about 27 inches thick and consists of friable, medium acid, yellowish brown sandy clay loam that has about 15 percent ironstone pebbles. The layer below that, to a depth of 100 inches, is friable, slightly acid, sandy clay loam that has a network of mottled red, yellowish brown, and gray mottles. It is about 25 percent plinthite in the upper part and 15 percent in the lower part.

Included with this soil in mapping are mainly small areas of Segno and Wockley soils, and a few small areas of Ozan and Kenney soils. These make up less than 10 percent of any mapped area.

This soil is used mainly for woodland grazing, timber, and improved pasture. A few acres are used for row crops and rice. Native vegetation is chiefly loblolly pine, water oak, sweetgum, red oak, beaked panicum, longleaf uniola, and sedges. Improved pastures are chiefly common bermudagrass, Coastal bermudagrass, and Pensacola bahiagrass.

This soil is moderately well drained. Surface runoff is slow. Internal drainage is medium above the layers that have plinthite and moderately slow in the layers that have plinthite. Permeability is moderately slow. Available water capacity is medium.

This soil is productive because of its favorable moisture and plant nutrient holding capacities. But fertilizer and crop residue management are needed for sustained high production. Capability unit IIs-1; rice group 2; pasture and hayland group 8C; Loamy Prairie range site; woodland suitability group 2o7; Sandy Loam woodland grazing group.

**HoB—Hockley fine sandy loam, 1 to 4 percent slopes.** This is a gently sloping soil in forest areas and pastures. The areas are generally irregular and about 100 acres in size. Slopes are slightly convex and average 2 percent.

This soil is similar to that described as representative of the Hockley series, but it commonly has a slightly thinner and sandier surface layer and brighter colors. The surface layer is very friable, medium acid, dark grayish brown fine sandy loam about 4 inches thick. The layer below that is very friable, medium acid, grayish brown fine sandy loam about 16 inches thick, The next layer is about 24 inches thick and consists of friable, medium acid, yellowish brown sandy clay loam that has about 15 percent ironstone pebbles. The layer below that, to a depth of 65 inches, is friable, slightly acid sandy clay loam that has a network of red, yellowish brown, and gray mottles and has about 25 percent plinthite.

Included with this soil in mapping are small areas of Segno, Boy, and Kenney soils, which make up less than 15 percent of any mapped area.

This soil is used mainly for woodland grazing, timber and improved pasture. A few areas are used for row crops, mainly corn and grain sorghum. Woodland vegetation is chiefly loblolly pine, water oak, sweetgum, beaked panicum, longleaf uniola, and sedges. Improved pasture grasses are mainly bermudagrass and bahiagrass.

This soil is moderately well drained. Surface runoff is medium, and the hazard of erosion is moderate. Internal drainage is medium above the layers that have plinthite and moderately slow in the layers that have plinthite. The available water capacity is medium. Permeability is moderately slow.

Fertilizer is needed in cultivated areas. Crop residue management, terraces, and contour farming are needed to help control moisture conservation and erosion control. Grassed waterways or diversions helps protect the soil from runoff water. Capability unit IIe-1; pasture and hayland group 8C; Loamy Prairie range site; woodland suitability group 207; Sandy Loam woodland grazing group.

**Is—Ijam soils**. These are nearly level soils on coastal flats in areas that are about 25 acres in size. The soil boundaries generally coincide with earthen dikes that were constructed to impound the clayey sediment dredged or pumped from the floor of waterways. The surface is plane to slightly concave. The slope is 0 to 1 percent but averages 0.1 percent.

The surface layer is very firm, moderately alkaline, dark gray clay about 8 inches thick. The layer below that, to a depth of 60 inches, is very firm, moderately alkaline, gray clay that has mottles of yellowish brown and a few shell fragments.

Included in some mapped areas of these soils are small areas of Harris, Kaman, Lake Charles, and Beaumont soils and some areas of Ijam soils that are very fine textured between the depths of 10 and 40 inches. Inclusions make up less than 5 percent of any mapped areas.

These soils are not suitable for cultivation. The vegetation is chiefly water-loving, salt-tolerant plants, such as gulf cordgrass and common reedgrass.

These soils are very poorly drained. The water table fluctuates from the surface in wet periods to a depth of about 30 inches in dry periods. Surface runoff is very slow to ponded. The available water capacity is medium.

Salinity and poor surface drainage are the main limitations. Newly deposited soil material may not support vegetation for several years, but older soils support some vegetation for livestock. Some areas are suitable for use as wildlife habitat. Capability unit VIIw-2; Salty Prairie range site.

**Ka—Kaman clay**. This is a nearly level soil on bottom lands in irregular, oblong areas that are about 80 acres in size. Slopes range from 0 to 1 percent but are dominantly less than 0.5 percent. The surface is plane to slightly concave.

The surface layer is about 39 inches thick. It is very firm, neutral, very dark gray clay in the upper part and very firm, mildly alkaline, black clay in the lower part. The layer below that is about 13 inches thick and consists of very firm, mildly alkaline, dark gray clay that has slickensides. The next layer, to a depth of 70 inches, is very firm, mildly alkaline, dark gray clay that has a few yellowish brown mottles and calcium carbonate concretions.

Included with this soil in mapping are small areas of Beaumont, Lake Charles, Harris, and Ijam soils. Also included are channel scars and partly filled old stream channels. These inclusions make up less than 5 percent of any mapped area.

This soil is used mainly for improved pasture, native pasture, and hardwood timber. Improved pasture plants are mainly dallisgrass, bermudagrass, and fescue. Native vegetation consists of elm, water oak, beech, willow oak, cypress, palmetto, sedges, longleaf uniola, and switch cane. If this soil is protected from overflow, it is suitable for cultivation.

This soil is poorly drained and is subject to flooding. Surface runoff is very slow. Internal drainage and permeability are very slow. This soil is saturated within 30 inches of the surface during most of the year. The available water capacity is high.

Excess water on the surface resulting from floods, the heavy clay texture of the soil, and poor tilth are the major limitations. Fertilization, drainage, and protection from flooding are needed for pasture and row crops. Capability unit Vw-1; pasture and hayland group 1A; woodland suitability group 1w6; Clayey Bottomland woodland grazing group.

**Kf—Katy fine sandy loam.** This is a nearly level soil in broad areas on the coastal prairie. The areas are generally high on the landscape and surround small depressions. They average several hundred acres, but some are several thousand acres in size. The surface is plane to slightly convex. The slope average is about 0.3 percent.

The surface layer is friable, medium acid, dark grayish brown fine sandy loam about 10 inches thick. The layer below that is friable, medium acid, brown fine sandy loam that extends to a depth of about 28 inches. The next layer, extending to a depth of more than 65 inches, is very firm, slightly acid clay loam mottled with gray, red, yellowish brown, and strong brown.

Included in the mapping of this soil are small areas of Gessner, Aris, Clodine, Edna, Wockley, and Hockley soils, which make up less than 10 percent of any mapped area. There are low, sandy, circular mounds in a few undisturbed areas.

This soil is used mainly for rice, improved pasture, and native pasture. A few small areas are used for grain sorghum and corn. Native vegetation is chiefly longleaf uniola, beaked panicum, little bluestem, indiangrass, greenbrier, berry vines, sedges, forbs, and annual weeds. Principal grasses for improved pasture are common bermudagrass, Coastal bermudagrass, and Pensacola bahiagrass.

This soil is somewhat poorly drained. It has a perched water table above the clay loam layer for short periods in cool months and in periods of excess rainfall. Surface runoff is slow to very slow. Internal drainage is slow. Permeability is very slow. The available water capacity is high.

Poor surface drainage is the major limitation. Fertilizer, lime, and artificial drainage are beneficial to pasture and crops. Capability unit IIIw-1; rice group 2; pasture and hayland group 8A; Loamy Prairie range site; woodland suitability group 2w8; Sandy Loam woodland grazing group.

**Kn—Kenney loamy fine sand**. This is a nearly level to gently sloping soil along ridges and natural drainageways. Soil areas are oblong and irregular and average about 100 acres, but some are 500 acres in size. The surface is plane to slightly convex. Slopes are mainly 0 to 1 percent, but the range is 0 to 3 percent.

The surface layer is about 9 inches thick. It is very friable, slightly acid, dark grayish brown loamy fine sand in the upper 5 inches and loose, slightly acid, dark brown loamy fine sand in the lower 4 inches. The layer below that is loose, medium acid, light yellowish brown loamy fine sand that extends to a depth of 56 inches. The next layer, extending to a depth of 80 inches, is friable, strongly acid, strong brown sandy clay loam.

Included with this soil in mapping are small areas of Hockley, Segno, and Boy soils. These soils make up less than 15 percent of the mapped area.

This soil is used mainly for woodland grazing. A few areas are used for timber, improved pasture, and cultivated crops. Loblolly pine and oak are common in most areas. Native grasses are mainly andropogons and panicums. Coastal bermudagrass, Pensacola bahiagrass, and weeping lovegrass are the principal improved pasture plants. A few areas are used for peanuts and watermelons, but inadequate moisture and fertility are limitations. A few areas of this soil are mined for sand for use in construction.

This soil is well drained. Surface runoff is very slow. Internal drainage is rapid, and permeability is moderately rapid. The available water capacity is low. Adequate moisture and improved fertility are needed for crops. Capability unit IIIs-1; pasture and hayland group 9B; Sandy

Prairie range site; woodland suitability group 3s2; Sandy woodland grazing group.

**Ku—Kenney-Urban land complex.** This complex is made up of nearly level to gently sloping soils along ridges and natural drainageways. It consists of built-up areas and new subdivisions. Soil areas are oblong and irregular and average about 50 acres, but some are 200 acres in size. The surface is plane to convex. Slopes range from 0 to 3 percent, but the average is 1 percent.

Kenney soils make up about 30 to 80 percent of this unit; Urban land, about 10 to 50 percent; and other soils, about 10 to 15 percent. The soils of this unit are so intricately mixed that separation was not feasible at the scale used in mapping.

The surface layer of the Kenney soils is very friable, slightly acid, dark grayish brown loamy fine sand in the upper 5 inches and loose, slightly acid, dark brown loamy fine sand in the lower 4 inches. The layer below that is loose, medium acid, light yellowish brown loamy fine sand that extends to a depth of 56 inches. The next layer, extending to a depth of 80 inches, is friable, strongly acid, strong brown sandy clay loam.

Urban land consists of soils that have been altered or covered by buildings and other urban structures. The main structures are single unit dwellings, garages, sidewalks, patios, driveways, streets, schools, churches, and paved parking lots. Urban land also consists of areas that have been altered by cutting, filling, or grading. Classification of all of these areas is not practical.

Included with this complex in mapping are Hockley, Segno, and Boy soils.

This mapping unit has moderate limitations for urban development. The thick sandy surface layer is low in fertility and is droughty. Lawns and shrubs are difficult to establish; adequate water and fertilizer are needed. The dry loose sand is unstable for traffic. Streets and roads need to be oiled, paved, or graveled.

**LcA—Lake Charles clay, 0 to 1 percent slopes.** This is a nearly level soil in broad, irregular areas that are 50 to several hundred acres in size. Slopes average 0.2 percent. Undisturbed areas are characterized by gilgai microrelief, which is destroyed in cultivation. In undisturbed areas, a mulch of fine, discrete, very hard aggregates is on the surface.

In the center of microdepressions, the surface layer is about 36 inches thick. In the upper 22 inches it is very firm, neutral, black clay. In the lower 14 inches it is very firm, mildly alkaline, very dark gray clay. The layer below that is about 16 inches thick and consists of very firm, mildly alkaline, dark gray clay that has intersecting slickensides. The next layer, to a depth of 74 inches, is very firm, mildly alkaline, gray clay that is mottled olive brown and yellowish brown.

Included with this soil in mapping are small areas of Beaumont, Bernard, Midland, Addicks, and Vamont soils and a few areas of this soil that are adjacent to Harris clay and that are slightly saline. These inclusions make up less than 10 percent of any mapped area.

This soil is used for cultivated crops, improved pasture, and native pasture. Rice is the main cultivated crop, but some areas are used for corn, cotton, and grain sorghum. Principal improved pasture plants are bermudagrass and dallisgrass. Native pastures support andropogons and paspalums. Live oak and huisache are common in places.

This soil is somewhat poorly drained. Surface runoff is very slow. Permeability and internal drainage are very slow. The available water capacity is high. When this soil is dry, deep wide cracks form on the surface. Water enters rapidly through the cracks, but it enters very slowly when the soil is wet and the cracks are sealed.

Favorable structure and tilth are difficult to maintain in this soil, and the moisture range in which the soil can be cultivated is narrow. Surface crusts and plowpans are common in cultivated fields. Runoff is very slow in large, nearly level areas, resulting in excess water on the surface. Drainage and fertilization are beneficial in pasture and crop production. Capability unit IIw-1; rice group 1; pasture and hayland group 7A; Blackland range site; woodland suitability group 2w9; Blackland woodland grazing group.

**LcB—Lake Charles clay, 1 to 3 percent slopes.** This is a gently sloping soil along ridges and natural drainageways. The soil areas are oblong and oval. They average 30 acres, but some are as large as 150 acres in size. The surface is plane to convex. The slope average is 2 percent, but some areas along drainageways have slopes of up to 4 percent. A mulch of fine, discrete, very hard aggregates is on the surface.

This soil has a slightly thinner surface layer than that described as representative of the Lake Charles series. The surface layer is about 30 inches thick. In the upper 18 inches it is very firm, neutral, black clay. In the lower 12 inches it is very firm, mildly alkaline, very dark gray clay. The layer below that is about 18 inches thick and consists of very firm, mildly alkaline, dark gray clay that has intersecting slickensides. The lower layer, to a depth of 60 inches, is very firm, mildly alkaline, gray clay that has mottles of olive brown and yellowish brown.

Included with this soil are small areas of Beaumont, Bernard, Midland, and Vamont soils, which make up less than 10 percent of any mapped area. Small areas, along drainageways, that have been eroded by water are also included.

This soil is used mainly for improved pasture and native pasture. Bermudagrass and dallisgrass are the principal improved pasture plants. Native pasture grasses are mainly ardropogons and paspalums.

This soil is somewhat poorly drained. Surface runoff is medium. Permeability and internal drainage are very slow. The available water capacity is high. Water erosion is a moderate hazard. When this soil is dry, deep, wide cracks form on the surface. Water enters rapidly through the cracks but enters very slowly when the soil is wet and the cracks are sealed.

This soil requires careful management to improve water intake and reduce runoff. Erosion reduces soil fertility and leaves the soil vulnerable to further erosion. If this soil is cultivated, terraces, contour farming, and protected terrace outlets are needed. Capability unit IIIe-1; pasture and hayland group 7A; Blackland range site; woodland suitability group 2w9; Blackland woodland grazing group.

**Lu—Lake Charles-Urban Land complex.** This is a nearly level complex in broad, irregular areas that range from 20 acres to about 1,800 acres in size. Slopes are mainly 0 to 1 percent, but range from 0 to 3 percent in some areas leading to drainageways.

Lake Charles soils make up 20 to 85 percent of this unit; Urban land, 10 to 75 percent; and other soils, 15 percent or less. The areas making up this complex are so intricately mixed that separation was not feasible at the scale used in mapping.

The surface layer of the Lake Charles soil is about 36 inches thick. In the upper 22 inches it is very firm, neutral, black clay. In the lower 14 inches it is very firm, mildly alkaline, very dark gray clay. In the layer below that it is about 16 inches thick and is very firm, mildly alkaline, dark gray clay that has intersecting slickensides. The next layer, to a depth of 74 inches, is very firm, mildly alkaline, gray clay that has mottles of olive brown and yellowish brown.

Urban land consists of soils that have been altered or covered by buildings or other urban structures. Classifying these soils is not practical. Typical structures are single- and multiple-unit dwellings, streets, schools, churches, parking lots, office buildings, and shopping centers that are less than 40 acres in size. The Urban land includes remnants of Lake Charles soils that have been altered by cutting, filling, and grading in urban development. In many areas of this mapping unit 6 to 18 inches of fill material covers the natural soil.

Included with this complex in mapping are small areas of Beaumont, Bernard, Midland, and Vamont soils.

This mapping unit has severe limitations for urban development. The main limitation is the high shrink-swell potential of the clay, which results in buckled streets and sidewalks and cracked walls. Lawns and gardens are difficult to establish because of the high clay content of the soils.

**Md—Midland silty clay loam**. This is a nearly level soil in broad, generally irregular areas that average about 500 acres but range from 10 acres to about 2,000 acres in size. Slopes range from 0 to 1 percent but average about 0.5 percent.

The surface layer is firm, strongly acid, dark grayish brown silty clay loam about 7 inches thick. The layer below that is firm, medium acid, gray silty clay about 13 inches thick. The next layer, extending to a depth of 50 inches, is very firm, dark gray clay that is slightly acid in the upper part and neutral in the lower part. It has slickensides in the upper part. The next layer, extending to a depth of 72 inches, is very firm, moderately alkaline clay that is mottled gray, olive yellow, and brownish yellow.

Included with this soil in mapping are small areas of Bernard, Lake Charles, Beaumont, Ozan, and Gessner soils. These soils make up less than 15 percent of any one mapped area.

This soil is used mainly for native pasture, improved pasture, and rice. A few areas are used for row crops. Native pastures consist of tall prairie grasses, such as andropogons and paspalums. Improved pastures consist mainly of bermudagrass. A few areas are used for woodland grazing or for timber.

This soil is poorly drained. Surface runoff is very slow. Internal drainage is very slow, and permeability is very slow. The available water capacity is high.

Excessive water on the surface is the major limitation. It makes the soil cold and limits the kind of crops that can be grown. Drainage is needed in cultivated areas.

Crop residue management and fertilizer are needed to maintain soil tilth and productivity. Capability unit IIIw-1; rice group 1; pasture and hayland group 7C; Blackland range site; woodland suitability group 2w6; Blackland woodland grazing group.

**Mu—Midland-Urban land complex**. The soils in this mapping unit are nearly level and are in broad, irregular areas that range in size from about 30 to 600 acres. Slopes range from 0 to 1 percent, but the average is 0.5 percent. Most areas are open prairie, but some are covered with native hardwood trees.

Midland soils make up 20 to 75 percent of this complex; Urban land, 10 to 75 percent; and other soils, 15 percent or less. The soils are so intricately mixed that separation was not feasible at the scale used in mapping.

The surface layer of the Midland soil is firm, strongly acid dark grayish brown silty clay loam about 7 inches thick. The layer below that is firm, medium acid, gray silty clay about 13 inches thick. The next layer, extending to a depth of 50 inches, is very firm, dark gray clay that is slightly acid in the upper part and neutral in the lower part. It has slickensides in the upper part. The next layer, to a depth of 72 inches, consists of very firm, moderately alkaline clay that is mottled gray, olive yellow, and brownish yellow.

Urban land consists of soils that have been altered or covered by buildings and other structures, making classification impractical. Typical structures are single- and multiple-unit dwellings, driveways, sidewalks, garages and patios, streets, schools, churches, parking lots, office buildings, and shopping centers of less than 40 acres. Urban land includes remnants of Midland soils that have been altered by cutting, filling, and grading during urban development. Fill material covers the natural soil in many places.

Included in mapping are small areas of Bernard, Lake Charles, Beaumont, Ozan, and Gessner soils.

This mapping unit has severe limitations for urban development. Poor drainage and shrinking and swelling in the underlying layers are the main limitations.

**Na—Nahatche loam.** This is a nearly level soil on the flood plains of major streams and tributaries. Mapped areas are oblong and have smooth boundaries. They average about 60 acres, but some areas are 400 acres in size. Slopes range from 0 to 2 percent along some old stream channels but range mainly from 0 to 1 percent, and the average slope is 0.6 percent. A few areas are dissected by old channel scars.

The surface layer is friable, medium acid, dark grayish brown loam about 5 inches thick. The layer below that is friable, medium acid, grayish brown loam over firm, moderately alkaline, gray clay loam that has mottles of light gray and brownish yellow.

Included with this soil in mapping are small areas of Hatliff, Gessner, and Ozan soils. These soils make up less than 5 percent of any mapped area.

This soil is used mainly for woodland grazing and wildlife habitat. A few areas are used for timber and improved pasture. Native vegetation is chiefly loblolly pine, shortleaf pine, cypress, American sycamore, water oak, willow oak, cottonwood, sweetgum, southern sweetbay, and green ash. Grasses include Florida paspalum, Virginia wildrye, switchgrass, beaked panicum, and longleaf uniola. Improved pasture grasses are mainly bermudagrass and bahiagrass.

This soil is subject to flooding once to several times each year for a few days to about a month. A water table is within 20 inches of the surface mainly in winter or early in spring. This soil is somewhat poorly drained. Surface runoff is slow. Permeability is moderate. The available water capacity is medium.

This soil is generally not cultivated because it is in narrow areas and is subject to flooding. In a few places, diversion terraces and grassed waterways help protect this soil from the runoff from higher lying soils. Capability unit Vw-1; pasture and hayland group 2A; woodland suitability group 1w9; Loamy Bottomland woodland grazing group.

**Oa—Ozan loam**. This is a nearly level soil in broad areas and on the floor of enclosed depressions. Soil areas generally are lower on the landscape than the adjacent or surrounding soils. Broad areas of this soil are irregular in shape, and the small depressed areas are circular. The areas average 160 acres, but some are several hundred acres in size. Slopes are plane to slightly concave and average about 0.2 percent.

The surface layer is friable, medium acid, dark grayish brown loam about 2 inches thick. The layer below that is about 16 inches thick and consists of friable, strongly acid, light brownish gray loam that tongues into a slightly more clayey layer of friable, medium acid, light brownish gray loam about 33 inches thick. The next layer, extending to a depth of 65 inches, is friable, strongly acid, light brownish gray sandy clay loam mottled with red and yellowish brown.

Included with this soil in mapping are small areas of Gessner, Aris, Clodine, Hockley, Aldine, Midland, Bissonnet, and Wockley soils. Also included in a few areas are low, sandy, circular mounds. These inclusions make up less than 10 percent of any mapped area.

This soil is used mainly for woodland grazing and timber. A few areas are used for rice, row crops, and improved pasture. Vegetation is chiefly water oak, willow oak, elm, sweetgum, magnolia, pine, persimmon, palmetto, longleaf uniola, beaked panicum, little bluestem, indiangrass, greenbrier, berry vines, sedges, forbs, and annual weeds.

This soil is poorly drained. Surface runoff is very slow to ponded. The soil is saturated for extended periods in winter and in early spring. Water stands on the surface in depressions for long periods following heavy rains. Internal drainage and permeability are slow. The available water capacity is high.

Excess water on the surface is the major management concern. Fertilization, liming, and drainage are beneficial for pasture and row crops. Capability unit IVw-1; rice group 2; pasture and hayland group 8E; woodland suitability group 2w9; Flatwoods woodland grazing group.

**On—Ozan-Urban land complex**. The nearly level soils in this complex are in built-up rural and urban areas where the population is increasing. The areas are lower on the landscape than the surrounding soils. The boundaries of this complex generally coincide with those of built-up subdivisions. The surface is plane to slightly concave. Slopes range from 0 to 1 percent but average 0.2 percent.

Ozan soils make up about 30 to 85 percent of the mapping unit; Urban land, about 10 to 60 percent; and other soils, about 5 to 20 percent. The components of this unit are so intermingled that it is not practical to map them separately at the scale used.

The surface layer of the Ozan soil is friable, medium acid, dark grayish brown loam about 2 inches thick. The layer below that is about 16 inches thick and consists of friable, strongly acid, light brownish gray loam. It tongues into a slightly more clayey layer of friable, medium acid, light brownish gray loam that is about 33 inches thick. The next layer, to a depth of 65 inches, is friable, strongly acid, light brownish gray sandy clay loam mottled with red and yellowish brown.

Urban land consists of soils that have been altered or covered by buildings, and classification is impractical. Typical structures are single- unit dwellings, multiple-unit dwellings, garages, sidewalks, patios, driveways, and streets. Urban land consists also of remnants of Ozan and other soils that have been altered by cutting, grading, and filling.

Included with this complex in mapping are small areas of Gessner, Wockley, Midland, Aldine, and Bissonnet soils.

This mapping unit has severe limitations for urbanization. The most severe are wetness and a lack of adequate drainage outlets. Corrosivity is high, and many pipes erode or rust out within a few years. The soils are not suitable for use as septic tank filter fields. Lime and fertilizer may be needed before planting grasses and shrubs.

**SeA—Segno fine sandy loam, 0 to 1 percent slopes**. This nearly level soil is forested or pastured. It generally is higher on the landscape than the surrounding soils. Soil areas are irregular in shape and average 175 acres in size. Slopes are slightly convex and average 0.5 percent.

The surface layer is friable, very strongly acid, dark grayish brown fine sandy loam about 5 inches thick. The layer below that is friable, very strongly acid, pale brown fine sandy loam about 8 inches thick. The next layer is about 12 inches thick and consists of friable, very strongly acid, yellowish brown sandy clay loam. At a depth of 25 inches the friable, very strongly acid sandy clay loam is mottled brownish yellow and red and is about 15 percent plinthite. Below a depth of 42 inches, the soil is mottled with gray and gets grayer with increasing depth.

Included with this soil in mapping are small areas of Hockley, Wockley, Ozan, and Kenney soils. These soils make up less than 15 percent of any mapped area.

This soil is used mainly for woodland grazing, timber, and improved pasture. A limited acreage is used for crops and home gardens. Native vegetation is chiefly pine and hardwood trees, beaked panicum, and little bluestem. Improved pastures are mainly bermudagrass and bahiagrass.

This soil is moderately well drained. Surface runoff is slow. Internal drainage in the layers that have plinthite is moderately slow. Permeability is moderately slow. The available water capacity is medium.

If this soil is cultivated, fertilizer is needed. The soil is somewhat droughty because moisture and roots are restricted from penetrating into the plinthite layers. Capability unit IIs-1; pasture and hayland group 8C; woodland suitability group 2o7; Sandy Loam woodland grazing group.

**SeB—Segno fine sandy loam, 1 to 3 percent slopes**. This gently sloping soil is forested and pastured. Soil areas are irregular in shape and average 150 acres in size. Slopes are slightly convex and average about 2.0 percent.

This soil is very similar to the one described as representative of the series, but it commonly has a slightly thinner, sandier surface layer and slightly brighter colors throughout the profile. The surface layer is friable, very strongly acid, dark grayish brown fine sandy loam about 4 inches thick. The layer below that is friable, very strongly acid, pale brown fine sandy loam about 7 inches thick. The next layer is about 12 inches thick and consists of friable, very strongly acid, yellowish brown sandy clay loam. At a depth of 23 inches the friable, very strongly acid sandy clay loam is mottled brownish yellow and red and is about 15 percent plinthite. Below a depth of 40 inches, there are gray mottles and the soil gets grayer with increasing depth.

Included in some mapped areas of this soil are small areas of Hockley, Kenney, and Boy soils, which make up less than 15 percent of the acreage.

This soil is used chiefly for woodland grazing, timber, and improved pasture. A few areas are cultivated. Native vegetation is mainly pine and hardwood trees, sedges, and little bluestem. Improved pastures are mainly bermudagrass and bahiagrass.

This soil is moderately well drained. Surface runoff is medium. Internal drainage in the layers that have plinthite is moderately slow. Permeability is moderately slow, and the available water capacity is medium. The erosion hazard is moderate.

If this soil is cultivated, fertilizer is needed. Crop residue management, terraces, and contour farming are needed to conserve moisture and control erosion. Grassed waterways and diversions protect the soil from runoff. Capability unit IIe-1; pasture and hayland group 8C; woodland suitability group 2o7; Sandy Loam woodland grazing group.

**Ur—Urban land.** This mapping unit is mainly in the central part of the county, the hub of the Houston metropolitan area. It is made up of extensively built-up areas where 75 to, 100 percent of each mapped area is either covered by structures or disturbed by cutting, filling, or grading. The areas also include shopping centers 40 to 120 acres in size.

Included in mapping are small areas of moderately built-up areas where buildings and other structures cover only 40 to 60 percent of the surface. Also included are remnants of undisturbed soil and areas where the natural soil is covered by fill material. These inclusions make up as much as 25 percent of Urban land.

The soils making up Urban land have been so altered and obscured that they can not be classified.

**VaA—Vamont clay, 0 to 1 percent slopes**. This is a nearly level soil in areas that range from 10 to several hundred acres in size. Slopes average 0.5 percent. The surface in undisturbed areas is characterized by gilgai microrelief.

In the center of microdepressions, the surface layer is firm, medium acid, very dark grayish brown clay about 8 inches thick. The layer below that is about 16 inches thick and consists of firm, strongly acid clay prominently mottled with yellowish brown and gray. The next layer, extending to a depth of 70 inches, is very firm, strongly acid to medium acid, grayish brown clay that has a few yellowish brown and brownish yellow mottles. The next layer, extending to a depth of 94 inches, is very firm, slightly acid, gray clay.

Included with this soil in mapping are small areas of Beaumont, Lake Charles, Bernard, and Midland soils. Inclusions make up less than 10 percent of any mapped area.

Areas of this soil are used mainly for woodland grazing and timber. Primary native grasses are little bluestem, longleaf uniola, beaked panicum, and sedges. Pines and hardwoods are the principal wood crops. A few areas are used for rice and improved pasture. Bermudagrass and dallisgrass are the main improved pasture grasses.

When this soil is dry, deep, wide cracks form on the surface. Water enters the soil rapidly through the cracks, but it enters very slowly when the soil is wet and the cracks are sealed. This soil is somewhat poorly drained. Surface runoff is slow. Internal drainage is very slow, and permeability is very slow. The available water capacity is high.

Surface drainage and soil tilth are the main management concerns if the soil is used for crops other than timber. Capability unit IIIw-2; rice group 1; pasture and hayland group 7A; woodland suitability group 2w9; Blackland woodland grazing group.

**VaB—Vamont clay, 1 to 4 percent slopes**. This is a gently sloping soil in areas leading to the low terraces and flood plains of major streams and drainageways. Mapped areas range from 20 to several hundred acres in size. They are typically less than 300 yards wide and are several miles long in places. Slopes are dominantly 1 to 4 percent, but they average 3 percent. Some areas are steeper for short distances. In some areas, generally on microknolls and other areas not protected by vegetation, the surface layer has been removed and the underlying layers are exposed.

The surface layer is firm, medium acid, very dark grayish brown clay about 4 inches thick. The layer below that is about 14 inches thick and consists of firm, strongly acid clay that is prominently mottled with yellowish brown and gray. Below that, to a depth of 60 inches, is a layer of very firm, strongly acid to medium acid, grayish brown clay that has a few yellowish brown and brownish yellow mottles. The next layer, to a depth of 70 inches, is very firm, slightly acid, gray clay.

Included with this soil in mapping are small areas of Atasco, Aldine, Midland, and Beaumont soils. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mainly for woodland grazing and timber. Native vegetation is chiefly mixed pine and hardwoods, sedge, and switchgrasses and bluestem.

This soil is somewhat poorly drained. Surface runoff is rapid. Internal drainage is slow, and permeability is very slow. The available water capacity is high. Water erosion is a moderate hazard.

Erosion control is the main problem in managing this soil. Erosion can best be controlled by maintaining a good cover of grass. Capability unit IIIe-1; pasture and hayland group 7A; woodland suitability group 2w9; Blackland woodland grazing group.

**Vn—Vamont-Urban land complex**. This mapping unit is in broad, nearly level areas and in long and narrow, gently sloping areas leading to the low terraces and flood plains of major streams and drainageways. The areas range from 10 to 500 acres in size, and most are covered with pine and hardwood trees. Slopes are mainly 0 to 4 percent, but in some areas they are as much as 5 percent for short distances along drainageways.

Vamont soils make up 20 to 75 percent of this complex; Urban land, 10 to 70 percent; and other soils, 15 percent or less. These components are so intricately mixed that it is not feasible to separate them at the scale used in mapping.

The surface layer of the Vamont soil is firm, medium acid, very dark grayish brown clay about 8 inches thick. The layer below that is about 16 inches thick and consists of firm, strongly acid clay that is prominently mottled with yellowish brown and gray. Below this, to a depth of 70 inches, is a layer of very firm, strongly to medium acid, grayish brown clay that has a few yellowish brown and brownish yellow mottles. The next layer, to a depth of 94 inches, is very firm, slightly acid, gray clay.

Urban land consists of soils that have been altered or covered by buildings and other structures. Typical structures are single dwellings, multiple-unit dwellings, driveways, sidewalks, garages, patios, streets, schools, churches, parking lots, office buildings, and shopping centers of less than 40 acres. Also in this mapping unit are remnants of Vamont soils that have been altered by cutting, filling, and grading during urban development. Areas filled to provide better drainage are common.

Included with these soils in mapping are small areas of Lake Charles, Beaumont, Bernard, Midland, Atasco, and Aldine soils.

This mapping unit has severe limitations for urban development. Most areas, which are covered with pine and hardwoods, are desirable sites for urban development, but the high shrink-swell potential of the clay is a limitation to this use. Lawns and gardens are difficult to establish because the soils contain a large amount of clay.

**Vo—Voss sand.** This is a nearly level to gently sloping soil on the low terraces and flood plains of major streams and their tributaries. It is flooded one to several times each year. Mapped areas are oblong, irregularly shaped, and have smooth boundaries. They average 40 acres in size. The surface is plane to slightly convex. Slopes range from 0 to 2 percent, but they average 0.5 percent.

The surface layer is loose, medium acid, very dark grayish brown sand about 5 inches thick. The surface layer is underlain, to a depth of 70 inches, by loose, light gray sand that is slightly acid in the upper 25 inches and neutral in the lower 40 inches.

Included with this soil in mapping are small areas of Hatliff, Nahatche, Boy, and Kenney soils. These inclusions make up less than 10 percent of any mapped area.

This soil is used mainly for woodland grazing, timber, and wildlife habitat. Native vegetation is chiefly shortleaf pine, loblolly pine, oaks, sweetgum, and cottonwoods. The grasses include little bluestem, switchgrass, and indiangrass. Wooded areas along the fresh water streams are excellent wildlife habitat.

This soil is moderately well drained to somewhat poorly drained. Surface runoff is slow. Permeability is rapid. Internal drainage is impeded by a seasonal high water table. This soil is saturated in most years for periods of a few days to a few weeks mainly during the cool months. The static water table is seldom deeper than 7 feet. The available water capacity is very low.

Wetness and flooding are the major problems in managing this soil. Protection from flooding and application of fertilizer are desirable for maximum forage production. This soil is seldom cultivated. Capability unit VIw-1; pasture and hayland group 3A; woodland suitability group 3w8; Loamy Bottomland woodland grazing group.

**Vs—Voss soils.** This is a nearly level to gently sloping soil on sandbars and flood plains. The surface is plane to slightly convex and in places is dissected by channel scars and partly filled, old stream channels. Slopes range from 0 to 3 percent, but they average 1.0 percent. In the low areas this soil is frequently flooded. This flooding occurs during high intensity rains and whenever the creeks rise. The soil areas are oblong and crescent shaped and have smooth boundaries. They average 10 acres but are up to 80 acres in size.

The surface layer is loose, medium acid, dark grayish brown sand about 4 inches thick. It is underlain, at a depth of 4 to 60 inches, by loose, neutral sand that is light gray in the upper 18 inches and very pale brown in the lower 38 inches.

Included with this soil in mapping are areas of streambanks and recently water-washed sand in adjoining channels. Also included are small areas of Boy, Kenney, Nahatche, and Hatliff soils. These inclusions make up less than 5 percent of any mapped area.

This soil is not suitable for cultivation. Some of the higher areas or protected areas have native vegetation and support such grasses as little bluestem, switchgrass, switchcane, and indiangrass. These areas are used mainly to graze livestock. A few wooded areas along streams are good wildlife habitat. The lower areas lack vegetation, except for a few annual weeds, such as bladder pod. These areas are used as a source of sand for golf courses, concrete block plants, highway construction, and fill for concrete slabs.

This soil is subject to frequent flooding, washing, and deposition of soil material. Surface runoff is slow. Permeability is rapid, and the available water capacity is very low. Internal drainage is impeded by a seasonal high water table. The static water table is 2 to 5 feet below the surface in most places. This soil is moderately well drained to somewhat poorly drained. Capability unit VIw-1; pasture and hayland group 3A; woodland suitability group 3w8; Loamy Bottomland woodland grazing group.

**Wo—Wockley fine sandy loam.** This is a nearly level soil in broad areas of prairie and forest. The areas are irregularly shaped. They average 1,000 acres, but some are several thousand acres in size. The surface is plane to slightly concave. Slopes average 0.3 percent.

The surface layer is friable, strongly acid, dark grayish brown fine sandy loam about 7 inches thick. The layer below that is friable, medium acid, brown fine sandy loam to a depth of about 22 inches. Below that is a layer of firm, strongly acid, brown sandy clay loam mottled with yellowish brown, red, and light brownish gray. The next layer, beginning at a depth of 33 inches, is firm, medium acid, light brownish gray sandy clay loam mottled with light gray, red, and yellowish brown. It is about 12 percent plinthite.

Included with this soil in mapping are small areas of Hockley, Segno, Aris, Katy, Ozan, and Gessner soils. Also included are areas of narrow, irregularly shaped ridges and low circular mounds where the Wockley soil has a thicker surface layer than the one described as representative of the series. These inclusions make up less than 15 percent of any mapped area.

This soil is used mainly for rice and improved pastures of bermudagrass or bahiagrass. A limited acreage is used for timber, woodland grazing, and row crops. Corn and peanuts are the most common row crops.

This soil is somewhat poorly drained. Surface runoff is slow. Permeability is moderately slow, and the available water capacity is high.

Excess water on the surface during rainy periods is the main problem in managing this soil, and drainage ditches are needed. If this soil is cultivated, fertilizer should be applied and crop residue retained for maximum crop production. Capability unit IIIw-1; rice group 2; pasture and hayland group 8C; Loamy Prairie range site; woodland suitability group 2w8; Sandy Loam woodland grazing group.

**Wy—Wockley-Urban land complex.** The nearly level soils in this mapping unit are in areas of prairie and woodland. The areas are irregularly shaped and range from 40 to 500 acres in size.

Wockley soils make up 30 to 80 percent of this mapping unit; Urban land, 10 to 75 percent; and other soils, about 10 percent. The soils of this unit are so intricately mixed that it is not practical to separate them at the scale used in mapping.

The surface layer of the Wockley soil is friable, strongly acid, dark grayish brown fine sandy loam about 7 inches thick. The layer below that is friable, medium acid, brown fine sandy loam about 15 inches thick. The next layer is about 11 inches thick and consists of firm, strongly acid, brown sandy clay loam that is mottled with yellowish brown, red, and light brownish gray. The next layer, to a depth of 60 inches, is firm, medium acid, light brownish gray sandy clay loam mottled with yellowish brown and red. It is about 12 percent plinthite.

Urban land consists of soils that have been altered or covered by buildings and other structures. These include houses, garages, schools, churches, sidewalks, driveways, streets, ditches, and a few small commercial buildings and accompanying parking lots. Alteration of the natural soil by cutting and filling is generally slight in older, more established communities. In these communities, excavation has left shallow borrow ditches along side streets and roads. The soil material from the ditches has been used in preparing roadbeds. In recent housing developments, the curbed streets are normally recessed, and the material excavated from the roadbed has been used to elevate the lots and yards. Consequently a thin layer of fine sandy loam covers the Wockley soils in these areas.

Included in mapping this complex are small areas of Katy, Aris, Hockley, Ozan, and Gessner soils.

The use of soils in this unit for urban purposes is generally moderately limited. The major limitation is excess water on the surface after periods of rainfall. The normal drainage practices normally used in areas of urban development generally are adequate and provide a stable soil surface for structures. Only minimal preparation of the soil is needed for landscaping or gardening. Frequent but light applications of water and chemicals are needed for the maximum growth and beauty of horticultural plants.

## Planning the Use and Management of the Soils

The soil survey is a detailed analysis and evaluation of the most basic resource of the survey area—the soil. It may be used to fit the use of the land, including urbanization, to the limitations and potentials of the natural resources and the environment and to help avoid soil-related failures in uses of the land.

During a soil survey soil scientists, conservationists, engineers, and others keep extensive notes, not only about the nature of the soils but also about unique aspects of behavior of these soils in the field and at construction sites. These notes include observations of erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic systems, and other factors relating the kinds of soil and their productivity, potentials, and limitations under various uses and management. In this way field experience incorporated with measured data on soil properties and performance is used as a basis for predicting soil behavior.

Information in this section will be useful in applying basic facts about the soils to plans and decisions for use and management of soils for crops and pasture, range, woodland, and many nonfarm uses, including building sites, highways and other transportation systems, sanitary facilities, parks and other recreational developments, and wildlife habitat. From the data presented, the potential of each soil for specified land uses may be determined, soil limitations to these land uses may be identified, and costly failures in homes and other structures, because of unfavorable soil properties, may be avoided. A site can be selected where the soil properties are favorable, or practices can be planned that will overcome the soil limitations.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area, and on the environment. Both of these factors are closely related to the nature of the soil. Plans can be made to maintain or create a land use pattern in harmony with the natural soil.

Contractors can find information useful in locating sources of sand and gravel, road fill, and topsoil. Other information indicates the presence of wetness or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, trees and shrubs, and most other uses of land are influenced by the nature of the soil.

## Management of Cropland

In Harris County, the kind of management and the intensity needed vary with the kind of soil and the type of farming. Drainage, erosion control, conservation of soil moisture, and maintenance of soil tilth, organic-matter content, and fertility are all good management practices.

Many of the soils are poorly drained, and surface or subsurface drainage systems are needed in many places for satisfactory yields. A good cropping system helps protect the soils from erosion during critical periods, such as heavy rains, flooding, drought, or strong winds. Such a system also conserves soil moisture; maintains or improves soil tilth, especially in clayey soils; and helps to control weeds, insects, and plant diseases. High temperatures in summer and moisture rapidly decompose large amounts of organic material. Consequently, the cropping system should include crops that produce large amounts of organic residue.

In a good cropping system, crops are grown in a sequence or in rotation, and soil-improving crops are grown to offset the adverse effect of soil-depleting crops. Soil-improving crops, such as grasses and legumes, leave large amounts of residue on or near the surface.

The use of commercial fertilizers and lime should be determined by the results of soil tests and by the needs of crops. The amount and kind of fertilizer needed varies according to the soil, the crop to be grown, the yield desired, previous land use, the season, and the amount of available moisture. Information on soil testing and application of fertilizer can be obtained from the Soil Conservation Service or the Agricultural Extension Service.

## Capability Classes and Subclasses

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, horticultural crops, or other crops that require special management. This classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering purposes.

In the capability system, the kinds of soils are grouped at three levels: capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (None in the county.)

Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial plants. (None in the county.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* indicates that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* indicates that water in or on the soil interferes with plant growth or cultivation (in some soils, wetness can be partly corrected by artificial drainage); *s* indicates that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example IIe-1 or IIIw-2. Thus, in one symbol, the Roman numeral designates the capability class or degree of limitation; the small letter indicates the subclass or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Harris County are described and suggestions for use and management are given.

### Capability Unit IIe-1

This unit consists of deep, gently sloping, moderately well drained soils that have a surface layer of fine sandy loam and lower layers of sandy clay loam or clay. Permeability is moderately slow or very slow, and the available water capacity is medium or high. These soils are moderately susceptible to water erosion.

Most areas of these soils are used for woodland grazing, woodland, and improved pasture. A limited acreage is used for such row crops as corn, cotton, and grain sorghum.

Among good management practices are those that control erosion and maintain fertility and tilth. Contour tillage, terracing, and grassed waterways help to control erosion. A cropping system that includes deep-rooted crops that produce a large amount of residue also helps to reduce erosion and maintain organic matter content.

### Capability Unit IIw-1

This unit consists of deep, nearly level, somewhat poorly drained or poorly drained soils. These soils have a surface layer of clay or clay loam and lower layers of clay. In a few areas of pimple mounds, the surface layer is fine sandy loam. Permeability is very slow, and the available water capacity is high. Slow surface runoff results in excess water on the surface in some areas.

These soils are used for crops and pasture. Corn, cotton, rice, grain sorghum, and forage are the chief crops.

Good management practices are those that help control erosion and maintain fertility and tilth. Drainage is needed in some areas. Structure and tilth are difficult to maintain. The cropping system should include crops that produce a large amount of residue, and the residue should be kept on or near the surface of the soil.

### Capability Unit IIs-1

The soils in this unit are deep, nearly level, and moderately well drained. They have a surface layer of fine sandy loam and lower layers of sandy clay loam. Permeability is moderately slow, and the available water capacity is medium. They are somewhat droughty because the penetration of moisture and root growth is restricted in the lower layers. The soils have low fertility.

Most areas of these soils are used for woodland grazing, woodland, and improved pasture. A few small areas are used for corn, grain sorghum, cotton, rice, and vegetables.

Soil management practices that maintain fertility and tilth are needed. The response to applications of fertilizer is good. The cropping system should include broadcast and row crops that produce a large amount of residue. The crop residue should be kept on or near the surface so that a high level of organic matter content is maintained and erosion is reduced.

### Capability Unit IIIe-1

This unit consists of deep, gently sloping soils that have a surface layer and lower layers of clay. Permeability is very slow, and the available water capacity is high. Erosion is a moderate hazard.

These soils are used mainly for improved pasture and native pasture. A few areas are used for cultivated crops, mainly cotton, corn, and grain sorghum.

Management needs are control of erosion and maintenance of fertility and tilth. Terraces, contour cultivation, and grassed waterways help control erosion. Because the texture is clayey, structure and tilth are difficult to maintain. The cropping system should include frequent plantings of crops that produce a large amount of residue. The residue should be kept on or near the surface.

### Capability Unit IIIw-1

This unit consists of deep, nearly level, somewhat poorly drained and poorly drained soils. These soils have a surface layer of loam, silty clay loam, fine sandy loam, or very fine sandy loam and lower layers of loam, sandy clay loam, silty clay loam, or clay. Pimple mounds occur in some areas. Permeability is moderate to very slow, and the available water capacity is medium or high.

These soils are used for cultivated crops, pasture, woodland grazing, and woodland. Cotton, corn, rice, grain sorghum, soybeans, and forage are the main crops.

Excess water on the surface is the major problem. Good management practices include water removal, maintenance of high organic matter content, and improvement of tilth. Row direction and use of shallow drains may be needed for drainage. These soils respond well to applications of fertilizer. The cropping system should include deep-rooted plants and crops that produce a large amount of residue. The residue should be kept on the soil.

**Capability Unit IIIw-2**

In this unit are deep, nearly level somewhat poorly drained or poorly drained soils. These soils have a surface layer and lower layers of clay. Permeability is very slow, and the available water capacity is high.

These soils are used for crops and pasture. The main crops are cotton, corn, rice, grain sorghum, and forage.

Excess water on the surface is a problem. Management is needed that helps to remove water and that maintains soil productivity and tilth. Because the surface layer is clay, structure and tilth are difficult to maintain. The cropping system should include deep-rooted plants and row or broadcast crops that produce a large amount of residue. The residue should be kept on or near the surface. Row direction and the use of shallow drains are needed for drainage in some areas.

**Capability Unit IIIw-3**

Boy loamy fine sand is the only soil in this unit. It is deep, nearly level, and somewhat poorly drained. It has a thick surface layer of loamy fine sand and fine sand and a lower layer of sandy clay loam. Permeability is rapid in the surface layer and moderately slow in the lower layer. The available water capacity is low. During wet periods, this soil is saturated in and just above the lower layer.

This soil is used mainly for pine woodland and woodland grazing, but a few areas are in pasture and crops. The main cultivated crops are corn, oats, vegetables, and forage.

Management is needed that prevent leaching, maintains the organic matter content, and improves tilth. The cropping system should include frequent plantings of crops that produce a large amount of residue. This residue helps to maintain a high level of organic matter, to improve fertility, and to increase the water-holding capacity of the soil.

**Capability Unit IIIs-1**

Kenney loamy fine sand is the only soil in this unit. It is deep, nearly level to gently sloping and well drained. It has a thick surface layer of loamy fine sand and a lower layer of sandy clay loam. Permeability is moderately rapid, and the available water capacity is low.

This soil is used mainly for woodland grazing. A few areas are used for timber, pasture, and cultivated crops and a few areas are used for cotton, corn, peanuts, and watermelons.

Useful management practices are those that control erosion, prevent leaching, and maintain fertility and tilth. The cropping system should include close growing crops that produce a large amount of residue. The residue should be kept on or near the soil surface. Fertilizer should be applied frequently in small amounts during the growing season.

**Capability Unit IVw-1**

This unit consists of deep, nearly level, poorly drained soils. These soils have a surface layer of loam and lower layers of loam or sandy clay loam. They are in low, depressed areas and at times remain wet or ponded for long periods after heavy rains. Permeability is moderate or slow, and the available water capacity is medium.

These soils are used mainly for pasture, woodland grazing, and woodland. Some areas are cultivated in fields where adjacent soils are cultivated. Cotton, corn, grain sorghum, and rice are the main crops.

Good management includes the drainage of excess water and the improvement of fertility. The cropping system should include crops that produce a large amount of residue. This residue should be kept on or near the surface.

### Capability Unit Vw-1

In this unit are nearly level, poorly drained to somewhat poorly drained soils that are on flood plains of streams. They have a surface layer of clay or clay loam and lower layers of clay loam, sandy clay loam, or clay loam. Permeability is very slow to moderate, and the available water capacity is high to medium. These soils are subject to flooding.

The soils in this unit are used mainly for pasture, woodland grazing, and woodland. The main concerns of management are improving fertility and maintaining the soil cover. Small applications of fertilizer should be made frequently during the growing season.

### Capability Unit VIw-1

The soils in this unit are nearly level and moderately well drained to somewhat poorly drained. They are on the flood plains of streams. They have a surface layer of loam, fine sandy loam, or sand and lower layers of fine sandy loam, loamy fine sand, or sand. In most years these soils are saturated for a few days to a few weeks, mainly in winter and early in spring. Some of the soils have a water table at a depth of 2 to 5 feet for 6 to 10 months of the year. Permeability is moderately rapid to rapid, and available water capacity is low to very low. These soils are subject to flooding.

These soils are used mainly for woodland and woodland grazing. Some areas consist of sandbars that are bare.

Management needs include the improvement of fertility and the maintenance of soil cover. Light applications of fertilizer should be made frequently during the growing season.

### Capability Unit VIIw-1

Harris clay is the only soil in this unit. It is deep, nearly level, and very poorly drained. It is clayey throughout. It is on the coastal marshlands and is subject to inundation at high tide. Permeability is very slow, and the available water capacity is low.

This soil is used mainly for grazing and wildlife habitat. The plants are chiefly water tolerant and salt tolerant.

Good management consists of maintaining soil cover. Drainage is beneficial in some areas.

### Capability Unit VIIw-2

Ijam soils are the only soils in this unit. They are deep, nearly level, and very poorly drained to ponded. They are clayey throughout. These soils are on coastal flats, and the soil material in which they formed consists of clayey sediments that were dredged or pumped from the floor of rivers, bayous, bays, or canals during the construction or maintenance of waterways. Permeability is very slow, and the available water capacity is medium.

These soils are not suitable for cultivation. Areas that have vegetation are used mainly as pasture.

Management includes the improvement of fertility and maintenance of soil cover.

### Yields Per Acre

The per acre average yields that can be expected of the principal crops under a high level of management are shown in table 3. In any given year, yields may be higher or lower than those indicated in table 3 because of seasonal variations in rainfall and other climatic factors. Absence of a yield estimate indicates that the crop is not suited to or not commonly grown on the soil or that irrigation of a given crop is not commonly practiced on the soil.

The predicted yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The latest soil and crop management practices used by many farmers in the county are assumed in predicting the yields. Hay and pasture yields are predicted for varieties of grasses and legumes suited to the soil. A few farmers may be using more advanced practices and are obtaining average yields higher than those shown in table 3.

The management needed to achieve the indicated yields of the various crops depends upon the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

For yields of irrigated crops it is assumed that the irrigation system is adapted to the soils and to the crop grown; that good quality irrigation water is uniformly applied in proper amounts as needed; and that tillage is kept to a minimum.

The predicted yields reflect the relative productive capacity of the soils for each of the principal crops. Yields are likely to increase in the future as new production technology is developed. The relative productivity of a given soil compared to other soils, however, is not likely to change.

Crops other than those shown in table 3 are grown in the survey area, but because their acreage is small, predicted yields for those crops are not included. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the productivity and management concerns of the soils for these crops.

## Use of the Soils for Rice

In 1973, Harris County ranked sixth in rice production in the state. A total of 31, 288 acres were planted.

The soils in Harris County that are suitable for growing rice have been placed in two rice suitability groups. The soils in each group have similar limitations and hazards, require similar management, and have similar productivity and other responses to management.

### Rice Group 1

This group consists of deep, nearly level soils that have a surface layer of clay, clay loam, or silty clay loam and lower layers of clay or silty clay. In a few areas where pimple mounds have been leveled, the surface layer is thin fine sandy loam. The soils in this group are somewhat poorly drained to poorly drained. Permeability is very slow, and the available water capacity is high. Because the surface layer is fine textured, these soils can be cultivated without damage within only a narrow range of moisture content.

These soils have somewhat high natural fertility and are the most productive soils for rice in the county.

Good management practices include fertilization, weed control, insect control, and water management. Some areas need lime. Irrigation systems should include levees, land leveling, water distribution systems, good water management, and surface drainage systems. Crop residue should be kept on or near the surface.

### Rice Group 2

This group consists of deep, nearly level soils that have a surface layer of loam, fine sandy loam, or very fine sandy loam and lower layers of loam, sandy clay loam, or clay. There are pimple mounds in some areas. These soils are moderately well drained to poorly drained. Permeability is moderate to very slow, and the available water capacity is medium to high.

These soils have low to moderate natural fertility and are only moderately productive for rice.

Management needs include fertilization, weed control, insect control, and water management. Some areas need lime. Irrigation systems should include levees, land leveling, water distribution systems, good water management, and surface drainage systems. Crop residue should be kept on or near the surface.

## Use of the Soils for Pasture and Hay

Pastures and hayland in Harris County are mainly in warm season grass. In some areas they support a combination of warm season grasses and cool season legumes. The main warm season grasses are common bermudagrass, Coastal bermudagrass, dallisgrass, and Pensacola bahiagrass. The most common legumes are vetch, white clover, crimson clover, Austrian winter peas, and singletary peas. These legumes are generally overseeded on established stands of bermudagrass and dallisgrass.

The major management practices needed on pasture are fertilization, weed control, and controlled grazing. Fertilizer should be applied according to plant needs, the level of production desired, and the results of soil tests. Weeds can be controlled by mowing or shredding. Weed control on well managed pasture is less of a concern than it is on overused, poorly managed pastures.

Temporary pastures are often used to supplement permanent ones or to produce hay. Hybrid forage sorghums are good supplemental summer plants. In a few areas, Hubam clover and cowpeas are planted on idle cropland. Small grains provide good supplemental winter forage.

In Harris County, hay is made largely from native bluestem, introduced bluestem, bermudagrass, bahiagrass, or annual forage sorghum. Yields range from 1/2 ton to 6 tons or more per acre depending on the soil type, the grass, the amount of fertilizer applied, and management practices.

Management of areas used for hay is generally the same as that for pasture. The hay should be cut at a height that is best for the grass. Cutting too close to the ground or cutting too often damages hayland in the same way that overgrazing damages pasture.

The soils in Harris County have been placed in 10 pasture and hayland groups according to their suitability for the production of forage. The soils in each group are enough alike to be suited to the same grasses, to have similar limitations and hazards, to require similar management, and to have similar productivity and other responses to management. The pasture and hayland groups in Harris County are identified by numerals and letters according to a statewide system of classification. Not all of the pasture and hayland groups in this system are represented in Harris County. For this reason not all the group numbers and letters are consecutive.

**Pasture and Hayland Group 1A—Heavy Clayey Bottomland**

Kaman clay is the only soil in this group. It is a deep, nearly level alluvial soil on stream bottoms. This soil is clayey throughout. It is poorly drained and is very slowly permeable. It is subject to flooding and is saturated during cool, moist periods.

This soil is used mainly for pasture, but some areas are used for hay. Common bermudagrass and dallisgrass are the principal grasses.

Good management of pasture includes stocking at the proper rate, rotating grazing, and controlling weeds. On well-managed hayland, fertilizer is applied and forage is cut at the proper stage of growth for maximum palatability and nutritional value. Care should be taken to cut hay at a height that does not damage the root system or impair plant vigor.

**Pasture and Hayland Group 2A—Loamy Bottomland**

This group consists of deep alluvial soils along stream bottoms. These soils are moderately well drained to somewhat poorly drained. They have a surface layer of loam. The lower layers are stratified clay loam to loamy fine sand and are moderately permeable or moderately rapidly permeable. These soils are subject to flooding and are saturated for short periods during winter and early in spring.

Soils in this group are used for both pasture and hay. Common bermudagrass, Coastal bermudagrass, and bahiagrass are the principal grasses.

Good management of pasture includes stocking at the proper rate, fertilizing according to soil test, rotating grazing, and controlling weeds. On well-managed hayland, fertilizer is applied and forage is cut at the proper stage of growth for maximum palatability and nutritional value. Care should be taken to cut hay at a height that does not damage the root system or impair plant vigor.

**Pasture and Hayland Group 3A—Sandy Bottomland**

This group consists of deep, alluvial soils along stream bottoms. These soils are sandy throughout, are moderately well drained to somewhat poorly drained, and are rapidly permeable. They are subject to flooding and are saturated for periods of a few days mainly during the cool months.

Soils of this group are used mostly for pasture. Common bermudagrass and Coastal bermudagrass are the main grasses.

Good pasture management includes stocking at the proper rate, fertilizing in small and frequent applications, rotating grazing, liming, and controlling weeds. On well-managed hayland, fertilizer is applied and forage is cut at the proper stage of growth for maximum palatability and nutritional value. Care should be taken to cut hay at a height that does not damage the root system or impair plant vigor.

**Pasture and Hayland Group 7A—Heavy Clayey Upland**

This group consists of deep, nearly level to gently sloping, clayey soils on uplands. These soils are calcareous and noncalcareous clay throughout. They are somewhat poorly drained to poorly drained and are very slowly permeable.

Soils of this group are used for pasture and hay. Common bermudagrass, Coastal bermudagrass, dallisgrass, forage sorghums, and legumes are the main pasture and hayland plants.

Good pasture management includes stocking at the proper rate, rotating grazing, applying fertilizer, and controlling weeds. On well-managed hayland, fertilizer is applied and forage is cut at the proper stage of growth for maximum palatability and nutritional value. Care should be taken to cut hay at a height that does not damage the root system or impair plant vigor.

**Pasture and Hayland Group 7C—Friable Clayey Upland**

This group consists of deep, nearly level soils that are somewhat poorly drained to poorly drained. These soils have a surface layer of clay loam, silty clay loam, loam, or fine sandy loam and lower layers of clay, silty clay, or loam. They are moderately permeable to very slowly permeable.

Soils of this group are used mainly for pasture. Common bermudagrass, Coastal bermudagrass, dallisgrass, and forage sorghums are the main plants.

Good pasture management includes stocking of the proper rate, rotating grazing, applying fertilizer, and controlling weeds. On well-managed hayland, fertilizer is applied and forage is cut at the proper stage of growth for maximum palatability and nutritional value. Care should be taken to cut hay at a height that does not damage the root system or impair plant vigor.

**Pasture and Hayland Group 8A—Tight Loam Upland**

This group consists of deep, nearly level to gently sloping, moderately well drained to poorly drained soils. These soils have a surface layer of fine sandy loam or very fine sandy loam and lower layers of sandy clay loam, clay loam, or clay. They are very slowly permeable.

Soils of this group are used for both pasture and hay. Common bermudagrass and Coastal bermudagrass are the principal grasses.

Good pasture management includes the use of proper stocking rates, fertilizer and lime, rotational grazing, and weed control. On well-managed hayland, fertilizer is applied and forage is cut at the proper stage of growth for maximum palatability and nutritional value. Care should be taken to cut hay at a height that does not damage the root system or impair plant vigor.

**Pasture and Hayland Group 8C—Loamy Upland**

This group consists of deep, acid, nearly level to gently sloping, moderately well drained or somewhat poorly drained soils. These soils have a fine sandy loam surface layer and sandy clay loam lower layers. They are moderately slowly permeable.

Soils of this group are used for both pasture and hay. Common bermudagrass, Coastal bermudagrass, and bahiagrass are the principal grasses.

Good pasture management includes the use of proper stocking rates, fertilizer and lime, rotational grazing, and weed control. On well-managed hayland, fertilizer is applied and forage is cut at the proper stage of growth for maximum palatability and nutritional value. Care should be taken to cut hay at a height that does damage the root system or impair plant vigor.

**Pasture and Hayland Group 8E—Wet Upland**

This group consists of deep, nearly level to slightly depressed, poorly drained soils. These soils have a surface layer of fine sandy loam or loam and lower layers of loam, sandy clay loam, clay loam, or clay. They are moderately permeable to very slowly permeable, and water ponds on the surface during rainy periods.

Soils of this group are used mostly for pasture, but some areas are used for hay. Common bermudagrass, Coastal bermudagrass, and bahiagrass are the main grasses.

Good pasture management includes simple drainage to remove ponded water. Proper stocking rates, rotational grazing, fertilizer, liming, and weed control are also needed. Fertilizer is needed on hayland. Forage should be cut at the height and stage of growth suitable for the grass used.

**Pasture and Hayland Group 9B—Deep Sandy Upland**

Kenney loamy fine sand is the only soil in this group. It is loamy fine sand in the upper part, which is 40 to 72 inches thick, and sandy clay loam in the lower part. It is well drained and moderately rapidly permeable.

This soil is used mostly for pasture, but some areas are used for hay. Common bermudagrass, Coastal bermudagrass, and weeping lovegrass are the main grasses.

Good pasture management includes the use of proper stocking rates, fertilizer and lime, rotational grazing, and weed control. On well-managed hayland, fertilizer is applied and forage is cut at the proper stage of growth for maximum palatability and nutritional value. Care should be taken to cut hay at a height that does not damage the root system or impair plant vigor.

**Pasture and Hayland Group 9C—Wet Sandy Upland**

Boy loamy fine sand is the only soil in this group. It is loamy fine sand and fine sand in the upper part, which is35 to 68 inches thick, and sandy clay loam in the lower part. It is rapidly permeable in the upper part and moderately slowly permeable in the lower part. This soil is somewhat poorly drained and is saturated in the sandy clay loam layer and just above it for periods of 2 to 4 months during cool moist periods.

This soil is used mostly for pasture, but a few areas are used for hay. Common bermudagrass, Coastal bermudagrass, and bahiagrass are the principal grasses.

Well-managed pastures require the use of proper stocking rates, rotational grazing, fertilizer and lime, and weed control. On well-managed hayland, fertilizer is applied and forage is cut at the proper stage of growth for maximum palatability and nutritional value. Care should be taken to cut hay at a height that does not damage the root system or impair plant vigor.

## Use of the Soils as Range

Ranching and livestock farming are important enterprises in Harris County. Range and pasture make up about 25 percent of the county.

Range is land on which the climax plant community consists mainly of grasses, grasslike plants, forbs, and shrubs that are valuable for grazing and that occur in sufficient quantity to justify use of the site for grazing. Ranchers normally use improved pasture, supplemental pastures, and feed supplements, as well as range, for the best overall use of land resources. Cow-calf operations are the common enterprise on ranches in the county.

Most of the soils in the county are low in available phosphorus, and grasses on these soils do not contain enough phosphorus for optimum livestock production. Livestock need mineral supplements if they graze native range.

The forage is generally too low in protein for a balanced diet during fall and winter. Insects, such as mosquitoes, are a serious problem to cattle on range.

### Range Site and Condition Classes

The soils are classified into range sites according to the kind and amount of native vegetation that grows on them in any given climate. Soils in their natural condition support more than one kind of vegetation. The combination of plants that originally grew on a soil is called the potential vegetation. Potential vegetation is the most productive combination of native plants on any given range site.

Each range site differs from all others in its potential to produce native plants. The site is the product of all environmental factors responsible for its development. In the absence of abnormal disturbances and physical site deterioration, it supports a plant community that is different from that of other range sites, both in kind or proportion of plants and in annual yield.

Range condition is the present state of the vegetation of a range site in relation to the potential plant cover for that site. *Excellent* range has a plant cover that is 76 to 100 percent original vegetation. *Good* range has a plant cover that is 51 to 75 percent original vegetation. *Fair* range has a plant cover that is 26 to 50 percent original vegetation. On range that is in *poor* condition, not more than 25 percent of the original vegetation remains. By determining the range condition, a rancher can measure the approximate deterioration of the plant cover and have a basis for determining the amount of improvement needed.

If grazing is not managed, the better plants are grazed so heavily that they decrease. These high-quality native plants are referred to as decreasers. When the more palatable plants decrease in a pasture, second-choice plants tend to increase. These plants are referred to as increasers. If heavy grazing continues, the number of second-choice plants is reduced, and low-growing or ungrazable plants take their place. These poor-quality plants are referred to as invaders. This process of range deterioration can be reversed by grazing management. Almost all kinds of herbage on each range site is usable by cattle.

Where climate and topography are about the same, differences in the kind and amount of vegetation that range can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 4 shows, for each kind of soil, the name of the range site, the potential annual production of herbage in favorable, normal, and unfavorable years, and the names of major plant species and the percentage of each in the composition of the potential plant community.

A range site supports a distinctive potential plant community, or combination of plants, that can grow on a site that has not undergone major disturbance. Soils that produce the same kind, amount, and proportion of range plants are grouped into range sites. Range sites can be interpreted directly from the soil map where the relationships between soils and vegetation have been correlated. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on range plants and their productivity. Soil reaction, salt content, and a seasonal high water table are also important.

Potential production refers to the amount of herbage that can be expected to grow on well-managed range that is supporting the potential plant community. It is expressed in pounds per acre of air-dry herbage for favorable, normal, and unfavorable years. A favorable year is one in which the amount and distribution of precipitation and the temperatures result in growing conditions substantially better than average; a normal year is one in which these conditions are about average for the area; an unfavorable year is one in which growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry herbage produced per acre each year by the potential plant community. All herbage, both that which is highly palatable and that which is unpalatable to livestock, is included. Some of the herbage also may be grazed extensively by wildlife, and some of it may not. Plant species that have special value for livestock forage are mentioned in the description of each soil mapping unit.

Common names are listed for the grasses, forbs, and shrubs that make up most of the potential plant community on each soil. Under the heading Composition in table 4, the proportion of each species is presented as the percentage, in dry-weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the season when the forage is grazed. All of the herbage produced is normally not used.

Range management requires, in addition to knowledge of the kind of soil and the potential plant community, an evaluation of the present condition of the range vegetation in relation to its potential production. Range condition is an expression of how the present plant community compares with the potential plant community on a particular kind of soil and range site. The more nearly alike the present kinds and amounts of plants and the potential plant community, the better the range condition. The usual objective in range management is to manage grazing so that the plants growing on a site are about the same in kind and amount as the potential native plant community for that site. Such management generally results in the maximum production of herbage, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential fits grazing needs, provides wildlife habitat, or provides other benefits, as well as protecting soil and water resources.

## Woodland Understory Vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants within the reach of livestock or of grazing or browsing wildlife. A well-managed wooded area can produce enough understory vegetation to support optimum numbers of livestock or wildlife, or both.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees, the density of the canopy, and the depth and condition of the forest litter. The density of the forest canopy is a major influence in that it affects the amount of light that understory plants receive during the growing season.

Table 5 shows, for each soil suitable for woodland, the potential for producing understory vegetation. The table also lists the common names of the major native understory plants that grow on a specified soil and the percentage composition of each by air-dry weight. The kind and percentage of understory plants listed in the table are those to be expected where canopy density is most nearly typical of forests that yield the highest production of wood crops.

The potential production of understory vegetation is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the soil moisture is above average during the optimum part of the growing season; in a normal year soil moisture is average; and in an unfavorable year it is below average.

## Woodland Management and Productivity

Table 6 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Mapping unit symbols for those soils suitable for wood crops are listed alphabetically by soil name, and the ordination symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the symbol, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low.

The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w* excessive water in or on the soil; *t,* toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates no significant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the order in which the letters are listed above—*x*, *w*, *t*, *d*, *c*, *s*, *f*, and *r*.

The third part of the symbol, a number, indicates the degree of management problems and the general suitability of the soils for certain kinds of trees. The problems considered in Harris County are erosion hazard, equipment limitation, seedling mortality, windthrow hazard, and plant competition. The number 2 indicates that soils have one or more *moderate* woodland management problems, and that they are best suited for needleleaf trees. The number 6 indicates that soils have one or more *severe* woodland management problems, and that they are best suited for broadleaf trees. The number 7 indicates that soils have no or only *slight* woodland management problems, and that they are suitable for either needleleaf or broadleaf trees. The number 8 indicates that soils have one or more *moderate* woodland management problems, and that they are suitable for either needleleaf or broadleaf trees. The number 9 indicates that soils have one or more *severe* woodland management problems, and that they are suitable for either needleleaf or broadleaf trees.

In table 6 the soils are also rated for a number of factors to be considered in management. The ratings of slight, moderate, and severe are used to indicate the degree of major soil limitations.

Ratings of equipment limitation reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings when plant competition is not a limiting factor. The ratings are for seedlings from good planting stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe,* more than 50 percent.

Ratings of plant competition indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The potential productivity of merchantable trees on a soil is expressed as a site index. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands.

*Trees to plant* are those that are suitable for commercial wood production and that are suited to the soils.

## Wildlife Habitat

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the development of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, inadequate, or inaccessible, wildlife will either be scarce or will not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by properly managing the existing plant cover, and by fostering the natural establishment of desirable plants.

In table 7 the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in—

1. Planning the use of parks, wildlife refuges, nature study areas, and other developments for wildlife.
2. Selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat.
3. Determining the intensity of management needed for each element of the habitat.
4. Determining areas that are suitable for acquisition to manage for wildlife.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention are required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and requires intensive effort. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

*Grain and seed crops* are seed-producing annuals used by wildlife. Examples are corn, sorghum, wheat, oats, barley, millet, buckwheat, cowpeas, soybeans, and sunflowers. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

*Grasses and legumes* are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Examples are fescue, Browntop millet, lovegrass, bahiagrass, ryegrass, kobe lespedeza, singletary peas, clover, vetch, bicolor lespedeza, and crownvetch. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, flood hazard, and slope. Soil temperature and soil moisture are also considerations.

*Wild herbaceous plants* are native or naturally established herbaceous grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are bluestem, indiangrass, croton, beggarweed, pokeweed, partridgepea, ragweed, fescue, and switchgrass. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, and flood hazard. Soil temperature and soil moisture are also considerations.

*Hardwood trees* and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Examples of native plants are oak, mulberry, cherry, sweetgum, pecan, hawthorn, dogwood, persimmon, sassafras, sumac, hickory, plum, black walnut, blackberry, grape, blackhaw, blackgum, maple, honeysuckle, dewberry, and greenbrier. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated good are Russian-olive, autumn-olive, and crabapple. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness.

*Coniferous plants* are cone-bearing trees, shrubs, or ground cover that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Examples are pine, cypress, Eastern red cedar, and coast juniper. Major soil properties that affect the growth of coniferous plants are depth of the root zone, available water capacity, and wetness.

*Shrubs* are bushy woody plants that produce fruits, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Examples are American beautyberry, farkleberry, yaupon, and possumhaw. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture.

*Wetland plants* are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Examples of wetland plants are smartweed, wild millet, spikerushes, sedges, bullrushes, arrowhead, saltgrass, cordgrass, and cattail. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, and slope.

*Shallow water areas* are bodies of surface water that have an average depth of less than 5 feet and are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control devices in marshes or streams. Examples are muskrat marshes, waterfowl feeding areas, wildlife watering developments, beaver ponds, and other wildlife ponds. Major soil properties affecting shallow water areas are wetness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed.

The kinds of wildlife habitat are briefly described in the following paragraphs.

*Openland habitat* consists of croplands, pastures, hay meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include fire ants, bobwhite quail, mourning dove, pheasant, prairie chicken, song birds, ducks, geese, cottontail rabbit, skunks, red fox, and coyotes.

*Woodland habitat* consists of hardwoods or conifers or a mixture of both, with associated grasses, legumes, and wild herbaceous plants. Examples of wildlife attracted to this habitat are armadillo, wild bees, crows, song birds, woodpeckers, tree squirrels, gray fox, raccoon, deer, and opossum.

*Wetland habitat* consists of water-tolerant plants in open, marshy, or swampy shallow water areas. Examples of wildlife attracted to this habitat are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, mink, beaver, nutria, and alligators.

Harris County is also a winter home for geese, ducks, egrets, herons, rails, coots, gallinules, and other migratory birds.

## Recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreational use by the duration of flooding and the season when it occurs. Onsite assessment of height, duration, and frequency of flooding is essential in planning recreational facilities.

In table 8 the limitations of soils are rated as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

Camp areas require such site preparation as shaping and leveling tent and parking areas, stablizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet nor subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and not wet nor subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over rock should be sufficient to allow necessary grading.

The design and layout of paths and trails for walking, horseback riding, and bicycling should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

## Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction materials, and water management. Among those who can benefit from this section are engineers, landowners, community decision makers and planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in tables in this section are based on test data and estimated data in the “Soil Properties” section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by the soil survey and used in determining the ratings in this section are grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness characteristics, depth to a seasonal water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

Based on the information assembled about soil properties, ranges of values may be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values may be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to—(1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternate routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternate sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

*Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations and testing.*

The information is presented mainly in tables. Table 10 shows, for each kind of soil, ratings of the degree and kind of limitations for building site development; table 9, for sanitary facilities; and table 12, for water management. Table 11 shows the suitability of each kind of soil as a source of construction materials.

Some of the terms used in this soil survey have different meanings in soil science and in engineering; the Glossary defines many of these terms.

## Sanitary Facilities

Favorable soil properties and site features are needed for proper -functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that deal with the ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 9 shows the degree and kind of limitations of each soil for these uses and for use of the soil as daily cover for landfills.

If the degree of soil limitation is indicated by the rating *slight, soils* are favorable for the specified use and limitations are minor and easily overcome; if *moderate, soil* properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe, soil* properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance are required.

*Septic tank absorption fields* are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect the absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and a shallow depth to bedrock interfere with installation. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas. Also, soil erosion and soil slippage are hazards where absorption fields are installed in sloping soils.

Some soils are underlain by loose sand and gravel at a depth less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and as a result ground water supplies in the area may be contaminated.

Percolation tests are performed to determine the absorptive capacity of the soil and its suitability for septic tank absorption fields. These tests should be performed during the season when the water table is highest and the soil is at minimum absorptive capacity.

In many of the soils that have moderate or severe limitations for septic tank absorption fields, it may be possible to install special systems that lower the seasonal water table or to increase the size of the absorption field so that satisfactory performance is achieved.

*Sewage lagoons* are shallow ponds constructed to hold sewage while bacteria decompose the solid and liquid wastes. Lagoons have a nearly level flow area surrounded by cut slopes or embankments of compacted, nearly impervious soil material. They generally are designed so that depth of the sewage is 2 to 5 feet. Impervious soil at least 4 feet thick for the lagoon floor and sides is required to minimize seepage and contamination of local ground water. Soils that are very high in organic matter and those that have stones and boulders are undesirable. Unless the soil has very slow permeability, contamination of local ground water is a hazard in areas where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce its capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the location of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soils affect the performance of embankments.

*Sanitary landfill is* a method of disposing of solid waste, either in excavated trenches or on the surface of the soil. The waste is spread in layers, compacted, and covered with thin layers of soil. Landfill areas are subject to heavy vehicular traffic. Ease of excavation, risk of polluting ground water, and trafficability affect the suitability of a soil for this purpose. The best soils have a loamy or silty texture, have moderate or slow permeability, are deep to bedrock and a seasonal water table, are free of large stones and boulders, and are not subject to flooding. In areas where the seasonal water table is high, water seeps into the trenches and causes problems in excavating and filling the trenches. Also, seepage into the refuse increases the risk of pollution of ground water. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability that might allow noxious liquids to contaminate local ground water.

Unless otherwise stated, the ratings in table 9 apply only to soil properties and features within a depth of about 6 feet. If the trench is deeper, ratings of slight or moderate may not be valid. Site investigation is needed before a site is selected.

In the area type of sanitary landfill, refuse is placed on the surface of the soil in successive layers. The limitations caused by soil texture, depth to bedrock, and stone content do not apply to this type of landfill. Soil wetness, however, may be a limitation because of difficulty in operating equipment.

*Daily cover for sanitary landfills* should be soil that is easy to excavate and spread over the compacted fill during both wet and dry weather. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

In addition to these features, the soils selected for final cover of landfills should be suitable for growing plants. In comparison with other horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas, such as slope, erodibility, and potential for plant growth.

### Building Site Development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 10. *A slight* limitation indicates that soil properties are favorable for the specified use; any limitation is minor and easily overcome. *A moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

*Shallow excavations* are used for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by the soil wetness of a high seasonal water table, the texture and consistence of soils, the tendency of soils to cave in or slough, and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

*Dwellings and small commercial buildings* referred to in table 10 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high.

Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence from settling or shear failure of the foundation do not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Slope was also considered in determining the ratings. Susceptibility to flooding is a serious limitation.

*Local roads and streets* referred to in table 10 have an all-weather surface that can carry light to medium traffic all year. They consist of subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The AASHTO and Unified classifications of the soil and the soil texture, density, and shrink-swell potential are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, and depth to very compact layers, all of which affect stability and ease of excavation, were also considered.

### Construction Materials

The suitability of each soil as a source of road fill, sand, gravel, and topsoil is indicated in table 11 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed and described as the survey is made, generally about 6 feet.

*Road fill* is soil material used in embankments for roads. The ratings reflect the ease of excavating and working the material and the expected performance of the material after it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about soil properties that determine such performance is given in the descriptions of soil series.

The ratings apply to the soil profile between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within the profile. The estimated engineering properties in table 16 provide more specific information about the nature of each horizon that can help determine its suitability for road fill.

According to the Unified soil classification system, soils rated *good* have low shrink-swell potential, are at least moderately well drained, and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as high shrink-swell potential, steep slopes, or wetness. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor,* regardless of the quality of the suitable material.

*Sand and gravel* are used in great quantities in many kinds of construction. The ratings in table 11 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 16.

*Topsoil* is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to sustain the growth of plants. Also considered is the damage that would result to the area from which the topsoil is taken.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are low in content of gravel and other coarse fragments, and have gentle slopes. They are low in soluble salts, which can limit plant growth. They are naturally fertile or respond well to fertilization. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel or soluble salt.

Soils rated *poor* are very sandy soils, very firm clayey soils, soils with suitable layers less than 8 inches thick, soils having large amounts of gravel or soluble salt, steep soils, and poorly drained soils.

Although a rating of *good is* not based entirely on high content of organic matter a surface horizon is much preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter. Consequently, careful preservation and use of material from these horizons is desirable.

**Water Management**

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 12 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the rated use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

*Pond reservoir areas* hold water behind a dam or embankment. Soils suitable for this use have low seepage potential, which is determined by the permeability and depth over fractured or permeable bedrock or other permeable material.

*Embankments, dikes, and levees* require soil material that is resistant to seepage, erosion, and piping and is of favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

*Drainage* of soil is affected by such soil properties as permeability, texture, structure, depth to claypan or other layers that influence rate of water movement, depth to the water table, slope, stability of ditchbanks, susceptibility to flooding, salinity and alkalinity, and availability of outlets for drainage.

*Irrigation is* affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

*Terraces and diversions* are embankments, or a combination of channels and ridges, constructed across a slope to intercept runoff and allow the water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity of slope and steepness, depth to bedrock or other unfavorable material, permeability, ease of establishing vegetation, and resistance to water erosion, soil blowing, soil slipping, and piping.

*Grassed waterways* are constructed to channel runoff at nonerosive velocities to outlets. Features that affect the use of soils for waterways are slope, permeability, erodibility, and suitability for permanent vegetation.

## Use of the Soils for Town and Country Planning

In Harris County, rapid population growth and increased mobility have placed more people in situations where soil conditions directly affect them. This is especially true in the rural-urban fringe areas where the development of residential subdivisions and the accompanying extension of public utilities create a need for soils information somewhat different from that needed for agriculture. Also, different soil information is needed where individual residential tracts, summer homes, and recreational facilities are well beyond public utilities. Land appraisers, realtors, city planners, builders, and individuals need facts that help them distinguish between sites that are suitable for houses or other buildings and those that should be reserved for other uses.

This section discusses soils in relation to site selection, foundations, sewage disposal systems, underground utility lines, control of erosion and runoff, gardening and landscaping, and public health.

### Site Selection

In selecting a site for the construction of buildings and other urban structures, the soil should be carefully investigated. Planners, builders, and maintenance men have made costly mistakes in selecting soils for proposed structures. If the soil is poorly suited to the intended use, there is little that can be done unless costly changes are made. In some instances, the structure can be designed to offset the limitations of the soil if the problem has been identified before construction begins.

The first and major consideration is susceptibility to flooding. The Hatliff, Kaman, Nahatchie, and Voss soils, all of which formed in alluvium, are subject to occasional or frequent flooding and should not be considered as sites for permanent structures. These soils should be reserved for greenbelts, sound barriers, wildlife habitat, hike and bike trails, picnicking, and other recreational uses. The Harris soils and Ijam soils did not form in alluvium, but they are subject to flooding and should not be used for urban structures.

Areas where soils formed in alluvium and areas that are within the intermediate regional flood plains (flooded once in a hundred years), as designated by the U.S. Army Corps of Engineers, are not necessarily the same. Areas within the intermediate regional flood plain include all alluvial soils and in most instances upland soils adjacent to the alluvial soils. These areas flood because a large percentage of the soils in the watershed are covered with urban structures that cause an increase in surface runoff. Information concerning the flood plains along seven major streams in the county is available from the Harris Soil and Water Conservation District. It was prepared by the U.S. Army Corps of Engineers. Additional information on areas subject to flooding is available from the U.S. Geological Survey.

Other soil features that affect site selection are permeability, available water capacity, drainage, reaction, shrink-swell potential, and corrosivity to steel and concrete. Also considered are hydrologic classification, suitability as septic tank absorption fields, suitability as sites for foundations and low-cost streets and roads, problems of erosion and runoff, potential for recreation use, suitability to grasses, flowers, vines, shrubs, and trees, as well as the relationship to overall general health of residents.

**Foundations**

Special attention needs to be given to the soils in determining if a site is suitable for foundations. In Harris County, some of the soils are montmorillonitic clay, which swells when wet and shrinks and cracks when dry. The pressure can be so great that walls and foundations crack even when specially reinforced. Damage because of shrink-swell potential is most likely to occur on Beaumont, Lake Charles, and Vamont soils. Other soils that have montmorillonitic clay in the lower layers are Bernard, Edna, Harris, Ijam, Kaman, and Midland soils. Other limitations to the use of soils for foundations are flooding, ponding, poor drainage, low strength, and high corrosivity.

**Sewage Disposal Systems**

Many new houses in Harris County are built in areas beyond municipal sewerlines where onsite sewage disposal systems must be established. The effectiveness of a sewer system depends largely on the absorptive capacity, permeability, percolation rate, wetness, flood hazard, seepage, and slope of the soils within the filter field (14).

The soils of Harris County, in general, are severely limited for use as septic tank absorption fields. In several areas of the county, the soils are dominantly clay, which is very slowly permeable. Many areas are poorly drained and remain wet for 1 to 4 months each year.

**Underground Utility Lines**

Water mains, gas pipelines, communication lines, and sewer pipes that are buried in the soil may corrode and break unless protected against certain electrobiochemical reactions resulting from inherent properties of the soil.

All metals corrode to some degree when buried in soil, and some metals corrode more rapidly in some soils than in others. The corrosion potential depends on the physical, chemical, electrical, and biological characteristics of the soil. For example, concentration of oxygen, concentration of anaerobic bacteria, moisture content, and such external factors as manmade electrical currents affect corrosion potential. In a few places, the risk of corrosion is intensified by connecting two dissimilar metals, by burying metal structures at varying depths, and by extending pipelines through different kinds of soils.

In table 13, the resistivity in ohms per cubic centimeter and the corresponding corrosion potential are given at 3-foot intervals to a depth of 18 feet for selected soils in Harris County. Electrical resistivity is only one factor in corrosion, but if measured, it indicates the probable corrosion potential of a soil. Electrical resistivity measures the resistance of a soil, when wet to field capacity, to the flow of electrical current. It is expressed in ohms per cubic centimeter. A low number indicates low resistivity (or high conductivity) and high corrosion potential.

An earth resistivity meter was used for measuring the resistivity of soils in Harris County. A four-electrode configuration was used, in which four probes were driven into the ground along a straight line and equidistant from each other. An alternating current was passed into the ground through the outer two probes, and the potential appearing across the inner two probes was measured.

Because the depth of the measured soil mass is directly proportional to the probe spacing, a record of electrical conductivity of the subsurface layers was obtained to the desired depth as the probe spacings were increased. These values were then converted into units of resistivity. The results of the tests were rounded off to the nearest 100 ohms per cubic centimeter. They were expressed as *high* if less than 2,000 ohms per cubic centimeter; *moderate* if 2,000 to 5,000 ohms per cubic centimeter; and *low* if more than 5,000 ohms per cubic centimeter.

Another soil characteristic affecting buried utility lines is shrink-swell potential (see table 17). In soils that have a high shrink-swell potential, the stress can break cast-iron pipe. To keep the pipes from breaking, it may be necessary to cushion them with sand.

**Control of Runoff and Erosion**

During urban construction natural vegetation is generally removed and large areas are covered with pavement, concrete, or buildings. In these areas runoff generally increases and the pattern of runoff changes. After a heavy rain, the runoff may be several times greater than it was when the same soils were used for farming. It accumulates in streets and gutters instead of flowing into natural waterways and results in flooding, erosion, and deposition of sediments in the lower areas.

Both mechanical control of erosion and runoff and the establishment of plants should begin with planning and designing before construction begins. Thus, the problems brought on by erosion, runoff, and sedimentation can be avoided or lessened (13).

Some mechanical measures that can be used to intercept, divert, convey, or retard the flow of water or otherwise control erosion and runoff are grading, bench terraces, subsurface drainage, diversions, storm sewers, and outlets, such as grassed waterways. Only areas to be used immediately for construction should be graded, not the entire site, and leaving large areas bare should be avoided. Bench terraces should be constructed across the slopes and made to fit the natural terrain. They should break up long slopes and slow the flow of runoff. If it is necessary to fill natural drainage channels, subsurface drains should be installed to help remove excess ground water. Diversions, which consist of a channel and a ridge constructed across the slope, intercept and divert runoff from areas where it can cause damage. They need a stable outlet to dispose of water safely. Berms, useful kinds of diversion, consist of compacted temporary or permanent earth ridges on slight grades, and they have no channels. Storm sewers dispose of runoff from streets and adjacent lots. The deposition of sediments downstream or even clogging the storm sewers can be prevented by constructing small sediment basins adjacent to sewer inlets. Grassed waterways or other outlets help dispose of water safely from other water disposal structures, parking lots, streets, and other areas.

Grade stabilization structures, special culverts, and different kinds of pipe, generally in combination with special vegetation, can be used to control erosion on soils so steep that a plant cover cannot be established. In areas where the soils are too steep or too unstable for erosion control, plastic or fiberglass mats can be used to temporarily line ditches and channels.

Hay, the straw from small grains, and certain processed materials can be used as mulch to protect sloping soils and other critical areas if the grading is completed at an unfavorable time for seeding. These areas can be seeded later without removing the mulch. The mulch has to be anchored with asphalt, by the use of straight blade disks, or netting, or by some other method. Hydromulching, in which seeds, fertilizer, and mulch are applied as a slurry, is a rapid, all-in-one operation that requires little labor.

Rapidly growing plants, such as annual rye grass and small grain, can be used where cover is needed for only a few months or a year or two. Bermudagrass, bahiagrass, weeping lovegrass, adapted legumes, trees, shrubs, and certain vines make good permanent ground cover. Most grasses and legumes need weeding, fertilizing, mowing, and other maintenance. Jute netting, cotton netting, paper netting, and fiberglass matting have special uses in controlling erosion and runoff. Most of these fibrous materials are used only temporarily to hold mulches in place or to control soil blowing or washing while the seedlings are getting established.

In many areas there are no overall plans for controlling runoff and erosion, and the choice of control measures is left up to the homeowner. In planning and applying measures that control runoff and erosion, special care should be taken to make sure that the measures are designed to fit in well with the homesite. Erosion control measures that can be used for small residential tracts are grading, use of contours, small diversions, waterways, and ditches or drain tile.

The surface of the soil should be graded so that it is level or gently sloping. Where the surface layer is loamy, the topsoil can be removed and stockpiled until it can be replaced on the graded surface.

Driveways, walks, fences, retaining walls, and raised flower beds can be constructed on the contour or, where that is not feasible, straight across the slope. Small diversions can be built to intercept runoff before it flows across erodible soils. They should be protected with a cover of permanent vegetation. Waterways can be constructed to help control gullying and to help drain soils where water stands. They must be shaped, smoothed, and established with sod. In places they may be constructed as small ditches along property lines. They generally empty into bar ditches or paved and curbed streets. Seep spots, waterlogged soils, and small ponded areas can generally be drained with ditches or tile drains, but filling some low areas with good topsoil may be needed.

### Potential of the Soils for Urbanization

The soils of Harris County are rated in table 14 for their potential for urbanization. The elements of urbanization that are rated are: dwellings without a basement but with a public sewer system, streets, shallow excavations in which to place utilities, and uncoated steel pipe. Shopping centers and small businesses are also considered in the rating.

The soils that have the highest potential for urbanization are those on which streets and structural foundations can be placed and not deteriorate because of adverse soil factors. In general, these same soils are easy to dig in, easy to grow plants in, and present a well drained, non-flooding landscape that is pleasing to the eye.

The factors considered in rating soil potential for the first three elements of urbanization are flooding, water table, wetness, shrink-swell potential, soil strength, and soil texture. The factors considered in rating soil potential for uncoated steel pipe are water table, wetness, soil texture, soil acidity, and electrical conductivity.

Soils that are subject to flooding have a low potential for urbanization because of the difficulty and expense involved in controlling floodwater.

Soils that are wet or have a high water table have medium to low potential for urbanization. Drainage systems can be installed to reduce wetness and lower the water table, but because of the flat landscape in Harris County, good drainage outlets are frequently several miles distant from the area where they are needed.

Soils that have a high shrink-swell potential or low soil strength have medium potential for urbanization. These factors can be partially overcome by increasing the strength of the structures. In Harris County such soils often have additional limitations, such as wetness, clay texture, and high corrosivity to uncoated steel, that further lower their potential for urbanization.

Clay soils are difficult to excavate, which adds to the cost of development and maintenance.

The corrosive effect of the soil on uncoated pipes can be partly overcome by using protective coatings, by attaching anodes to the metal, or by using more resistant metals or materials such as plastics or concrete.

In table 10, the limitations of a soil for building site development may reflect a single factor. For example, a soil having a high shrink-swell potential is rated as having a severe limitation because of a single factor. In table 14, the rating factors are cumulative, that is, a wet soil that shrinks and swells greatly and is highly corrosive to metals is rated lower than a soil that is only wet. Further, the ratings of the elements of urbanization—dwellings, streets, shallow excavations, and uncoated steel pipe—are also cumulative and indicate the overall potential of the soil for urbanization.

The potential of the soils for urbanization is very high for soils that have very few limitations that are likely to cause problems during construction or after development. The limitations can be easily and economically corrected. The potential is high for soils that have a few limitations that can cause problems during construction or after development. The limitations can be economically overcome. The potential is medium for soils that have several limitations that can cause problems during construction or after development. Some limitations can be easily overcome, but one or more will be difficult or expensive to overcome. The potential is low for soils that have several limitations that can cause problems during construction and after development. The limitations can be overcome only with difficulty and using very expensive measures. The potential is very low for soils that are subject to flooding. Most of these soils have other limitations that are difficult to overcome. These soils are best suited to uses other than urbanization.

### Gardening and Landscaping

Suburban homeowners need to know what kinds of soil they have and the kinds of flowers, ground cover, vines, shrubs, and trees to which the soils are best suited. In some areas plants may be needed to control erosion as well as for esthetic purposes.

Soils that are well suited to yard and garden plants have a deep root zone, a loamy texture, a balanced supply of plant nutrients, plenty of organic matter in various stages of decomposition, adequate water-supplying capacity, good drainage, and a granular structure that allows free movement of water, air, and roots. The degree of acidity or alkalinity suitable for the particular plants to be grown is also important. For example, roses and most annual flowers, most vegetables, and most grasses generally grow best in soils that are neutral or only slightly acid. Azaleas, camellias, and other similar plants grow in acid soils. Some plants that are grown in soils, such as Addicks soils, that contain a large amount of lime develop chlorosis, a yellowing of the leaves. The limy soils in Harris County are well suited to many flowers, shrubs, and trees, including shasta daisies, hollyhocks, petunias, zinnias, gladiolus, and other flowers and crapemyrtle, dogwood, pecan, fruitless mulberry, and other shrubs and trees.

Table 15 lists soils in the county and some of the flowers and ground cover, vines, shrubs, and trees that are suited to each. Harris clay, Ijam soils, and Urban land are not listed because they are not suited to those plants. In general the plants selected as suited to each soil can grow only in soils that have certain properties. For example, a plant that needs good drainage is suited only to moderately well drained or well drained soils, so such a plant is not listed for other soils. If that plant is grown in other soils, drainage, using tile drains or raised beds, must be provided.

It is generally less expensive and more advisable to condition the natural soil than to replace it with manmade soil material. Lime and fertilizer should be added according to the results of soil tests and the needs of the crop. The most important amendment to the soil is organic matter, which can be pine bark, rice hulls, peat moss, compost, rotted sawdust, or manure. At least 2 inches of organic matter should be added to the soil. For clayey soils, at least 2 inches of sand, perlite, calcined clay, or vermiculite should be added. In addition, 5 pounds of superphosphate (0-20-0) and 10 pounds of gypsum per 100 square feet should be broadcast. All of these materials should then be spaded or rototilled into the upper 8 inches of the natural soil. If an acid soil is desired, 1 to 2 pounds of sulfur should be incorporated. If soil is too strongly acid, it may be neutralized by adding bonemeal, lime, wood ashes, or limestone sand.

In some areas of the county, the soils are so clayey or so poorly drained that it may be necessary to construct raised beds to grow flowers and some shrubs. Brick, tile, metal, cedar, or redwood make good retainers along the edge of beds. Beds should be filled with good soil material and well balanced physical and chemical amendments.

All plants whether grown in natural soil or manmade soil require careful maintenance, especially during the period of establishment. Good management practices include fertilizing, watering, controlling weeds, and controlling insects.

Gardening and landscaping should be included in the basic plans for urban construction. The potential of the natural soil for the growing of plants should be considered when selecting the site. Also important is the protection of existing trees during construction. In timbered areas, large healthy trees are valuable and in places an irreplaceable asset to the property. Many trees that have a potential in landscaping are killed because of carelessness in excavation, filling, and construction. For guidelines for protecting trees, consult the nearest office of the Soil Conservation Service or the Agricultural Extension Service.

# Soil Properties

Extensive data about soil properties collected during the soil survey are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of samples selected from representative soil profiles in the field.

When he makes soil borings during field mapping, the soil scientist can identify several important soil properties. He notes the seasonal soil moisture condition, or the presence of free water and its depth in the profile. For each horizon, he notes the thickness of the soil and its color; the texture, or the amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or natural pattern of cracks and pores in the undisturbed soil; and the consistence of soil in-place under the existing soil moisture conditions. He records the root depth of existing plants, determines soil pH or reaction, and identifies any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to characterize key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many of the soil series are available from nearby areas.

Based on summaries of available field and laboratory data, and listed in tables in this section, are estimated ranges in engineering properties and classifications and in physical and chemical properties for each major horizon of each soil in the survey area. Also, pertinent soil and water features, engineering test data, and data obtained from laboratory analyses, both physical and chemical, are presented.

## Engineering Soil Classification Systems

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (USCS) (2) and that of the American Association of State Highway and Transportation Officials (AASHTO) (1). In table 16 soils in the survey area are classified according to both systems.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution, plasticity index, liquid limit, and organic matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols, for both classes, for example CL-ML.

The AASHTO system classifies soils according to those properties that affect use of the soils in highway construction and maintenance. In this system a mineral soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, the soils in group A-7 are fine grained. Highly organic soils are classified as A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the engineering value of subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or more for the poorest. The AASHTO classification of the soils tested in the survey area, is given in table 19 with the group index number in parentheses.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a dry clayey soil is increased, the soil material changes from solid to plastic. If the moisture content is further increased, the material changes from plastic to liquid. The plastic limit is the moisture content at which the soil material passes from solid to plastic. The liquid limit is the moisture content at which the material changes from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

## Engineering Properties

Table 16 gives estimates of engineering properties and texture classification for the major horizons of each soil in the survey area. The percentage passing sieve, liquid limit, and plasticity index are estimates given as a range.

Within the upper 5 or 6 feet, the horizons of most soils have contrasting properties. Depth to the upper and lower boundaries of each horizon is indicated for a typical profile.

Texture is described in table 16 in standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the soil material that is less than 2 millimeters in diameter. “Loam,” for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

## Physical and Chemical Properties

Table 17 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the representative profile of each soil. The estimates are based on field observations and on test data for these and similar soils.

*Permeability* is estimated on the basis of known relationships between the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for water movement in a vertical direction when the soil is saturated. Not considered in the estimates are lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in the planning and design of drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

*Available water capacity is* rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

*Soil reaction* is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops and ornamental or other plants to be grown, in evaluating soil amendments for fertility and stabilization, and in evaluating the corrosivity of soils.

*Shrink-swell potential* depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others it was estimated on the basis of the kind of clay and on measurements of similar soils. Size of imposed loadings and the magnitude of changes in soil moisture content are also important factors that influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. *A high* shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

*Risk of corrosion,* as used in table 17, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rating of soils for corrosivity to concrete is based mainly on the sulfate content, soil texture, and acidity. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Installations of steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely within one kind of soil or within one soil horizon.

*Erosion factors* are used to predict the amount of erosion that will result from specific kinds of land treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or wind, that may occur without reducing crop production or environmental quality. The soil-loss prediction procedure is outlined by the Agricultural Research Service, United States Department of Agriculture (12).

## Soil and Water Features

Features that relate to runoff or infiltration of water, to flooding, and to seasonal high water table are indicated in table 18. This information is helpful in planning land uses and engineering projects that are likely to be affected by the amount of runoff from watersheds, by flooding, and a seasonal high water table.

*Hydrologic groups* are used to estimate runoff after rainfall. Soil properties that influence the minimum rate of infiltration into the bare soil after prolonged wetting are depth to a water table, water intake rate and permeability after prolonged wetting, and depth to layers of slowly or very slowly permeable soil. The hydrologic groups are defined in the Glossary.

*Flooding is* rated in general terms that describe the frequency, duration, and period of the year when flooding is most likely. The ratings are based on evidences in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by flood-water; irregular decrease in organic-matter content with increasing depth; absence of distinctive soil horizons that form in soils of the area that are not subject to flooding; local information about floodwater heights and the extent of flooding; and local knowledge that relates the unique landscape position of each soil to historic floods. Most soils in low positions on the landscape where flooding is likely to occur are classified as fluvents at the suborder level or as fluventic subgroups. See the section “Classification of the Soils.”

The generalized description of flood hazards is of value in land use planning and provides a valid basis for land use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

*A seasonal high water table* is the highest level of a saturated zone more than 6 inches thick in soils for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed during the course of the soil survey. Indicated are the depth to the seasonal high water table; the kind of water table, whether perched or apparent; and the months of the year that the high water commonly is present. Only those saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not to construct basements and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

### Engineering Test Data

Table 19 gives the results of engineering tests performed by the Texas Highway Department on some of the soils in Harris County. The table shows the specific location where samples were taken, the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soil engineering.

Linear shrinkage is the decrease in one dimension, expressed as a percentage of the original dimension, of the soil mass when the moisture content is reduced from the stipulated percentage to the shrinkage limit.

As moisture leaves a soil the soil decreases in volume, in proportion to the loss in moisture, until a point is reached where shrinkage stops even though additional moisture is removed. The moisture content at which shrinkage stops is called the shrinkage limit. The shrinkage limit of a soil is a general indication of the clay content; it decreases as the clay content increases. In sand that contains little or no clay, the shrinkage limit is close to the liquid limit and is considered insignificant. As a rule, the load-carrying capacity of a soil is at a maximum when its moisture content is at or below the shrinkage limit. This rule does not apply to sand because, if confined, sand has a uniform load-carrying capacity within a considerable range in moisture content.

The shrinkage ratio is computed by dividing the amount of volume change resulting from the drying of a soil material by the amount of moisture lost through drying. The volume change used in computing shrinkage ratio is the change in volume that takes place in a soil when it dries from a given moisture content to a point where no further shrinkage takes place. The ratio is expressed numerically.

Volumetric shrinkage is the percent of volume at liquid limit. It was measured according to Texas Highway Department Test Method Tex-107-E.

In mechanical analysis, the soil components are sorted by particle size. Sand and other granular material are retained on a No. 200 sieve, but finer particles pass through it. Clay is the fraction smaller than 0.002 millimeter in diameter. Silt is intermediate in size between the material held on the No. 200 sieve and that having a diameter of 0.002 millimeter.

## Geology

Saul Aronow, Department of Geology, Lamar University, Beaumont, Texas, wrote this section.

Harris County is in the Western Gulf section of the Coastal Plain (7). The uppermost formations, from which the parent materials of soils in the county weathered, are of Pliocene, Pleistocene, and Holocene (Recent) age. These formations originally consisted of fluvial, deltaic, coastal marsh, and lagoonal soil materials and shallow sea deposits. Among the geologic and geomorphic features in the county are sedimentary deposits broken by normal faults, salt domes, pimple mounds, undrained depressions, and scarps.

The sedimentary deposits slope gently toward the Gulf of Mexico. They are broken by normal faults most of which dip toward the Gulf and extend downward many thousands of feet. The earth movements that caused these faults took place within the last 50,000 years. As Harris County has become urbanized, some of the faults have been reactivated, resulting in damage to pavement and to houses. Also, as pumping has withdrawn large amounts of ground water and lowered the artesian pressure in aquifers, the clay that enclosed the aquifers has dried and compacted. As the clay dried, especially in the areas adjacent to Galveston Bay, subsidence related to the faults took place and allowed flooding during periods of high tides and high winds.

The salt domes in this county are the Humble Dome in the northeastern part of the county, the Hockley Dome in the northwestern part, and the Pierce Junction, South Houston, Mykawa, and Webster Domes in the southern part. Except for the Humble and Hockley Salt Domes, these domes have not caused elevation of the land surface. In the area around Humble, which is elevated as a result of the Humble Salt Dome, the salt is at a depth of about 1,200 feet and the gypsum, anhydrite and limestone that cap the salt are at a depth of about 700 feet. The high relief in the northwestern part of the county where the Hockley Dome occurs is partly a result of that dome. In this area the salt is at a depth of about 1,600 feet, and the caprock, at a depth of less than 100 feet. The Hockley Mound, the highest topographic feature in the area, however, is not over the center of the Hockley Salt Dome.

Pimple mounds (4) are widespread on the Gulf Coast. They are circular knolls, generally less than 5 feet in height and less than 200 feet in diameter. In most places the soils that formed in these mounds have a loamy A horizon, which is typical of soils of the Edna, Katy, Aris, Clodine, and Wockley series.

The depressions in Harris County are shallow and circular to irregularly shaped. The soil material in these depressions is loamy. Where these low areas were under grass, soils of the Gessner series formed, but where they were under forest, soils of the Ozan series formed. These depressions should not be confused with those in areas of gilgai microrelief.

Separating the oldest formation, the Willis, from younger formations is the prominent Hockley Scarp, which can be seen about 6 miles southeast of Hockley where U.S. Highway 290 crosses it. The scarp trends in a southwest-northeast direction. It is probably an erosional scarp against which younger formations were deposited and is perhaps analogous to the cliffs along the shore of Galveston Bay or the scarps along the flood plain of the San Jacinto River. There is also a poorly defined scarp that separates the Bentley Formation from the flatter surface of the younger Montgomery Formation.

### Geologic History

The deposition of the materials of the several Pleistocene formations (with the probable exception of the Willis Formation) and of the more recent materials, which are of Holocene age, is related to the several rises and falls of sea level (luring and after the several last major advances of continental glaciers in North America (luring the past 1 to 3 million years. During periods when water was abstracted from the ocean to form glaciers, the sea fell, perhaps as much as 450 feet below its present level, and the major streams deepened their channels, flowed across the Continental Shelf, and discharged into the Gulf many miles beyond the present shoreline. During interglacial periods when water from the melting glaciers flowed back into the ocean, the sea rose, the deepened valleys backfilled and the several Pleistocene formations were deposited.

As time passed, each formation was progressively tilted more toward the Gulf from an original gradient of less than 1 foot per mile to more than 10 feet per mile. Also, streams increased the dissection of the land surface, and less and less of the original flat topography has remained between the stream channels.

The materials of the Beaumont Formation were deposited during the last of the interglacial periods. They may have been deposited during a mid-Wisconsin interglacial interval or during the Sangamon Stage, an interval between the Wisconsin and Illinoian glaciations. The Sangamon Stage is currently estimated as taking place about 70,000 years ago. According to the results of radiocarbon dating of wood and shell from the Beaumont Formation, this deposit is more than 40,000 years old, but all the material was “dead” and beyond the range of accurate analysis. After the materials of the Beaumont Formation had been deposited, the sea level fell again, but about 18,000 years ago, it started to rise and, about 5,000 to 3,500 years ago, reached its present level.

Although younger than the Beaumont Formation and considered by many geologists as Holocene in age, the Deweyville Formation ranges from about 12,000 to 34,000 years in age, according to radiocarbon dates for wood found in this formation. These dates are well within the time of the Pleistocene glaciers. The relationship between the deposition of the Deweyville and the rise and fall of sea level is not well understood.

**Relationship of geologic formations and soils**

The Willis Formation is the oldest geologic formation, and crops out in the northwestern part of the county. It is probably transitional in age from the Pliocene to the Pleistocene, or one million to three million years old. The surface topography in areas where this formation is exposed have more relief and greater dissection by streams than areas where other geologic formation are exposed. The origins of this formation are fluvial and deltaic, and the materials were probably deposited by the Pliocene or Pleistocene ancestor of the Brazos River. This formation is very sandy and, in places, contains fine gravel. It has abundant iron oxide concretions in the zone of weathering.

The Willis Formation underlies large areas within the Wockley-Gessner and Segno-Hockley associations.

The Bentley Formation is the next youngest, geologic formation. It crops out as a small area in the northwestern part of the county, principally around the communities of Tomball and Huffsmith. The origins of this formation are also fluvial and deltaic, and the materials were probably deposited by the Pleistocene ancestor of the Brazos River. This formation has characteristics similar to those of the Willis Formation, including the iron oxide concretions in the zone of weathering. Also, the soils that formed in parent material weathered from this formation are similar to soils that formed in material weathered from the Willis Formation.

This formation underlies part of the Wockley-Gessner association and parts of the Segno-Hockley association.

The Montgomery Formation, also Pleistocene and overlying the Bentley, crops out extensively in Harris County. It is in areas of gently sloping relief and many shallow, undrained depressions. These areas are also characterized by many pimple mounds, particularly in the north-central part of the county. The origins of this formation are also fluvial and deltaic. The materials of this formation are largely clay, silt, and sand, but the sand is well below the level of the parent material in which most of the soils formed. Many sand pits have been opened in areas where this formation crops out.

The Montgomery Formation underlies almost all of the Clodine-Addicks-Gessner and the Katy-Aris associations, as well as parts of the Wockley-Gessner and Segno-Hockley associations north of Cypress Creek.

The Beaumont Formation is the youngest formation of Pleistocene age that crops out extensively in Harris County. Its origins are mainly fluvial and deltaic, but probably some small areas originated as coastal marsh and lagoonal deposits.

This formation has a relict depositional pattern (3, 4, 6, and *15),* which is one of slightly elevated distributaries or meander ridges. The low areas that separate the ridges are the old surfaces of backswamps or flood basins, such as are found on present-day alluvial plains or as interdistributary depressions on existing deltas. A pattern of meandering streams is faintly discernable on the surface of ridges in Harris County. The parent material that weathered from this formation is more clayey than that weathered from the other formations.

The sediment making up this formation was derived from several different fluvial sources. In the area south of Buffalo Bayou and east of the San Jacinto River, the source was the Pleistocene ancestor of the Brazos River; east of Greens Bayou, west of Cedar Bayou at the eastern edge of the county, and north of Buffalo Bayou and the San Jacinto River, the sources may be the Pleistocene ancestors of the San Jacinto and Trinity Rivers.

This formation underlies nearly all the Lake Charles-Bernard association, the Midland-Beaumont association, and the Aldine-Ozan association. It underlies some small contiguous areas of the Clodine-Addicks-Gessner, Segno-Hockley, and Wockley-Gessner associations. In the two associations on prairies where the soils are nearly level and crack when dry, the soils that are more silty and loamy, such as those of the Bernard, Edna, and Midland series, occupy ridge areas where pimple mounds are abundant. The clayey soils of the Lake Charles and Beaumont series occupy the low areas between the ridges.

The Deweyville Formation underlies stream terraces flanking the lower reaches of Spring Creek and also underlies those along the San Jacinto River south of Lake Houston Dam. It is derived from fluvial deposits on point-bars, in channels, and on levees and thus consists mainly of sand, fine gravel, silt, and clay. The elevation of terraces underlain by this formation is intermediate between the upland, which is underlain by the Beaumont Formation, and the flood plain along the San Jacinto River.

South of Lake Houston, the Deweyville underlies the Nahatche-Voss-Kaman association and, along Spring Creek, part of the Segno-Hockley association. This formation is covered by water in the bay and by Holocene sediments along the lower reaches of the San Jacinto River.

Alluvium of Holocene (Recent) age has been deposited on all the flood plains and in some small areas of marsh along several small streams, such as Buffalo Bayou, Greens Bayou, Cypress Creek, and Spring Creek as well as along the San Jacinto River. This alluvium is derived from deposits in channels, on levees, on point bars, and in backswamps. The soil materials are clay, silt, sand, and some fine gravel. On most of the flood plain, these deposits occupy channels that were first cut and deepened as the sea level lowered during the Pleistocene, but the channels of these streams were later backfilled by the streams.

The soils that formed in this alluvium are in the Nahatche-Voss-Kaman association.

Among the publications that give information on geologic formations on the Gulf Coast are a standard reference on the geology of Texas *(8)*; the geologic map of Texas *(5)*; the more recent Environmental Geology maps *(6)*, and the Houston and Beaumont sheets of the Geologic Atlas of Texas *(9*, *10).*

# Classification of the Soils

This section describes the soil series of the survey area, defines the current system of classifying soils, and classifies the soils of the area according to that system.

## Soil series and morphology

On the following pages each soil series in the survey area is described in detail. The series descriptions are presented in alphabetic order by series name.

For each series, some facts about the soil and its parent material are presented first. Then a profile typical of the soil series in the survey area is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (11). Unless otherwise noted, the colors given are for moist soil.

Following the profile description is the range of important characteristics of the soil series. Then the soils in the series are compared with similar soils and with soils nearby. Phases, or mapping units, of each soil series are described in the section "Soil Maps for Detailed Planning."

### Addicks Series

The Addicks series consists of deep, neutral, nearly level, loamy soils on upland prairies. These soils have a layer of calcium carbonate enrichment at a depth of 23 to 49 inches (fig. 4). They formed in calcareous, loamy sediments.

These soils are poorly drained. A temporary water table is common for short periods following heavy rains. Surface runoff and internal drainage are slow. Permeability is moderate, and the available water capacity is high.

These soils are used for pasture and cultivated crops. Some are used for urban development.

Representative profile of Addicks loam, in a pasture, 3.5 miles north of the intersection of Texas Highway 6 and Interstate Highway 10 in Addicks, 1.85 miles east on Clay Road, and 75 feet south:

A—0 to 11 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; hard, friable; many fine roots; many fine pores; common worm casts; neutral; gradual wavy boundary.

B21t—11 to 23 inches; dark gray (10YR 4/1) loam, gray (10YR 5/1) dry; few fine faint mottles of strong brown; weak fine and medium subangular blocky structure; hard, friable; common fine roots; common fine pores; common worm casts of very dark gray (10YR 3/1) material; few iron-maganese concretions up to 5 millimeters in diameter; few patchy clay films slightly darker than matrix; few very fine calcium carbonate concretions in lower part of horizon; neutral; gradual wavy boundary.

B22tca—23 to 49 inches; light gray (10YR 7/1) loam, white (10YR 8/1) dry; matrix 30 to 40 percent light brownish gray (10YR 6/2); common fine faint pale yellow mottles and few fine distinct yellow mottles; weak coarse subangular blocky structure parting to weak fine subangular blocky; very hard, friable; few fine roots; common fine pores; few patchy clay films; few black concretions; few worm casts; few crayfish krotovinas filled with dark gray (10YR 4/1) material; 20 percent by volume visible calcium carbonate in the form of soft masses and concretions less than 1 centimeter in diameter; moderately alkaline; calcareous; clear wavy boundary.

B23t—49 to 78 inches; light gray (10YR 7/2) loam, white (10YR 8/2) dry; many fine and medium distinct yellow (2.5Y 7/6) mottles and common medium and coarse distinct yellowish brown (10YR 5/8) mottles; weak very coarse prismatic structure parting to weak medium and coarse subangular blocky; very hard, firm; few clay films; few black concretions; few crayfish krotovinas filled with very dark gray (10YR 3/1) and dark gray (10YR 4/1) loamy material; prism faces coated with light brownish gray loam 2 to 15 millimeters thick; 5 percent irregularly shaped pitted calcium carbonate concretions 1 to 6 centimeters in diameter; moderately alkaline; noncalcareous.

The A horizon is 10 to 18 inches thick. It is black, very dark gray, or very dark grayish brown and is slightly acid through moderately alkaline. The B2t horizon is dark gray, dark grayish brown, gray, grayish brown, light gray or light brownish gray. It has few to common distinct brownish and yellowish mottles. It is loam or silt loam in the upper part but ranges to silty clay loam in the lower part. It is neutral through moderately alkaline. Some part of the B2t horizon contains 15 to 40 percent calcium carbonate equivalent in the form of few to common soft masses and concretions with pitted surfaces.

### Aldine Series

The Aldine series consists of deep, acid, nearly level to gently sloping, loamy soils on uplands. These soils have a loamy surface and a clayey subsoil (fig. 5). They formed in thick beds of clayey sediments under forest vegetation.

Aldine soils are somewhat poorly drained. Surface runoff is slow, and permeability is very slow. The available water capacity is high. These soils are saturated at a depth of 20 to 30 inches during the cool months and during periods of excessive rainfall.

Most of these soils are used for timber production and woodland grazing. Some are used for urban development.

Representative profile of Aldine very fine sandy loam, in timber, 2.38 miles north of the intersection of Huffman-Cleveland Road and Farm Road 1960 in Huffman, 0.25 mile west on Wolf Road, and 150 feet north:

A1—0 to 5 inches; dark grayish brown (10YR 4/2) very fine sandy loam, grayish brown (10YR 5/2) dry; few fine faint brown mottles; moderate fine granular structure; slightly hard; friable; common tree routs; common fine grass roots; few worm casts; few 1- to 2-millimeter pockets of uncoated fine sand and silt; medium acid; abrupt smooth boundary.

A2—5 to 10 inches; grayish brown (10YR 5/2) very fine sandy loam, light brownish gray (10YR 6/2) dry; few fine faint yellowish brown mottles; weak medium subangular blocky structure; slightly hard, friable; common very fine pores; common worm casts; common 2- to 5-millimeter pockets of uncoated fine sand; medium acid; clear wavy boundary.

B&A—10 to 19 inches; yellowish brown (10YR 5/4) loam; few medium distinct light brownish gray (10YR 6/2), brown (10YR 4/3), and yellowish brown (10YR 5/6) mottles within the B material; weak fine and medium subangular blocky structure; hard, friable; few fine pores; grayish brown (10YR 5/2) vertical streaks and tongues of A2 material make up about 30 percent, by volume, of this horizon and surround the B material; common streaks and pockets of uncoated pale brown (10YR 6/3) fine sand within the A2 material; few black concretions 2 to 5 millimeters in diameter; common worm casts; very strongly acid; clear wavy boundary.

B21tg—19 to 30 inches; gray (10YR 6/1) clay; common medium distinct yellowish brown (10YR 5/6) and common fine prominent red mottles; weak medium subangular blocky structure parting to moderate very fine angular blocky; very hard, firm, plastic; few fine roots; discontinuous clay films on faces of peds; thin silt and sand coatings on some ped faces; very strongly acid; clear wavy boundary.

B22tg—30 to 50 inches; light gray (10YR 6/1) clay; common medium distinct yellowish brown (10YR 5/6) mottles; few fine distinct brownish yellow and red mottles; mottles make up less of soil mass than in B21tg horizon; moderate medium subangular blocky structure; very hard, firm, plastic; discontinuous clay films on faces of peds; very strongly acid; clear wavy boundary.

B3g—50 to 60 inches; light gray (10YR 6/1) clay loam; common fine distinct yellowish brown and prominent red (2.5YR 4/6) mottles; mottles decrease with depth; moderate medium subangular blocky structure; very hard, firm; slightly acid.

The A horizon is 6 to 20 inches thick. It is very strongly acid through medium acid. The A1 horizon is dark gray, dark grayish brown, gray, grayish brown, or brown. The A2 horizon is grayish brown, brown, light brownish gray, pale brown, light gray, or light yellowish brown. The B&A horizon is yellowish brown, brownish yellow, brown, light yellowish brown, or pale brown. Mottles are light brownish gray, light gray, brown, or any of the matrix colors. The B&A horizon is very fine sandy loam, loam, clay loam, or sandy clay loam. It is very strongly acid through medium acid. The B2t and B3 horizons are clay loam, silty clay, or clay. They are very strongly acid through slightly acid. The matrix is dominated by gray, light gray, grayish brown, or light brownish gray. Red mottles in the upper part of the B2t horizon make up 5 to 35 percent of the soil mass. The B2t horizon also has mottles of brownish yellow, yellowish brown, or strong brown.

**Aris Series**

The Aris series consists of deep, neutral, nearly level, loamy soils on upland prairies. These soils have a loamy upper layer about 21 inches thick that tongues into a more clayey lower layer (fig 6). They formed in thick loamy and clayey sediments.

These soils are poorly drained. Surface runoff and internal drainage are slow. Permeability is very slow. A water table is perched above the tongued layer during the cool months or during periods of excessive rainfall. The available water capacity is medium.

Areas of these soils are used mainly for rice, native pasture, and improved pasture. This soil is also used for urban development.

Representative profile of Aris fine sandy loam, in pasture, 3.2 miles north of the intersection of Interstate Highway 10 and Texas Highway 6 in Addicks, 1.8 miles west along Clay Road, 0.7 mile north on Gertie Rice Road, and 75 feet west:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; common fine faint dark yellowish brown mottles; weak fine granular structure; hard, friable; many fine roots; few worm casts; few fine pockets of uncoated fine sand; neutral; clear wavy boundary.

A2g—7 to 21 inches; grayish brown (10YR 5/2) fine sandy loam, light brownish gray (10YR 6/2) dry; common fine faint dark yellowish brown mottles; few fine faint reddish yellow mottles; weak fine subangular blocky structure; hard, friable; common fine roots; common fine pores; common worm casts; common fine pockets of uncoated fine sand; few crayfish krotovinas filled with very pale brown (10YR 7/3) uncoated fine sand and lined with dark grayish brown (10YR 4/2) clayey material; slightly acid; clear wavy boundary.

Bg&Ag—21 to 28 inches; gray (10YR 5/1) sandy clay loam, light gray (10YR 6/1) dry; common fine faint yellowish brown (10YR 5/4) mottles within the Bg material; moderate fine and medium subangular blocky structure; very hard, firm; few fine pores; grayish brown (10YR 5/2) A2g material occurs as tongues and interfingers and makes up about 20 percent, by volume, of this horizon; common 2-to 5-millimeter pockets of uncoated fine sand; few black concretions 2 to 5 millimeters in diameter; few worm casts; few crayfish krotovinas filled with very pale brown (10YR 7/3) uncoated fine sand and lined with dark grayish brown (10YR 4/2) clayey material; medium acid; clear wavy boundary.

B21tg—28 to 46 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; common fine and medium prominent red (2.5YR 4/8) mottles grading with depth to common fine distinct yellowish red (5YR 5/8) mottles; few fine strong brown mottles; moderate coarse prismatic structure parting to moderate fine and medium angular blocky; extremely hard, very firm; few fine roots; continuous clay films; few black concretions 2 to 5 millimeters in diameter; few crayfish krotovinas filled with very pale brown (10YR 7/3) uncoated fine sand; strongly acid; gradual irregular boundary.

B22tg—46 to 60 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common medium distinct reddish yellow (7.5YR 6/8) mottles; few fine prominent red (2.5YR 4/8) mottles, mainly surrounded by reddish yellow mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; extremely hard, very firm; patchy clay films; common fine yellowish brown stains along root channels; few black concretions 2 to 5 millimeters in diameter; grayish brown (10YR 5/2) fine sandy loam coatings 2 to 10 millimeters thick on prism faces; few crayfish krotovinas lined with grayish brown (10YR 4/2) clayey material and filled with loamy material and horizontal streaks of uncoated fine sand; medium acid; gradual irregular boundary.

B3g—60 to 78 inches; light gray (10YR 7/1) clay loam, white (10YR 8/1) dry; common fine reddish yellow (7.5YR 6/8) mottles and stains along fine root channels; moderate coarse prismatic structure parting to weak coarse subangular blocky; very hard, firm; grayish brown (10YR 5/2) fine sandy loam coatings 2 to 5 millimeters thick on prism faces; slightly acid.

The A horizon is 16 to 28 inches thick and is medium acid through neutral. The Ap horizon is mainly dark gray, dark grayish brown, or grayish brown. In a few areas where it is less than 6 inches thick, it is very dark gray or very dark grayish brown. Mottles are yellowish red, yellowish brown, strong brown, or dark yellowish brown. The A2g horizon is dark grayish brown or grayish brown. Mottles are dark yellowish brown, strong brown, yellowish brown, reddish yellow, or gray. The Bg&Ag horizon is dark gray or gray. Mottles are yellowish brown, strong brown, yellowish red, or gray. The Bg&Ag horizon is sandy clay loam, clay loam, or silty clay loam. It is strongly acid through slightly acid. The B2tg horizon is dark gray or gray in the upper part and gray or light gray in the lower part. Mottles are red, yellowish brown, strong brown, reddish yellow, or yellowish red. The B2tg horizon is mainly clay but ranges to clay loam or silty clay loam. It is strongly acid through slightly acid. The B3g horizon is gray or light gray. Mottles are yellowish brown, strong brown, reddish yellow, or yellowish red and clay loam or silty clay loam. The B3g horizon is strongly acid through neutral, but in a few places it is mildly alkaline.

**Atasco Series**

The Atasco series consists of deep, acid, gently sloping, loamy soils on forested uplands. These soils formed in clayey sediments, mainly along natural drainageways.

These soils are moderately well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is high. During wet periods these soils are saturated in the lower part of the profile for 2 to 4 months. The erosion hazard is moderate.

Areas of these soils are used mainly for timber production and for woodland grazing and pasture.

Representative profile of Atasco fine sandy loam, 1 to 4 percent slopes, in timber, from the intersection of U.S. Highway 59 and Farm Road 1960 in Humble, 900 feet northeast along U.S. Highway 59 to its intersection with poor motor road to gas well, 1.77 miles northwest on poor motor road, and 70 feet west:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable; common fine roots; few worm casts; organic litter 1 centimeter thick on the surface; strongly acid; clear smooth boundary.

A&B—5 to 16 inches, light yellowish brown (10YR 6/4) fine sandy loam, very pale brown (10YR 7/4) dry; common fine distinct strong brown (7.5YR 5/8) mottles; weak fine granular structure; slightly hard, friable; few fine pores; common worm casts; medium acid; clear wavy boundary.

B&A—16 to 19 inches; brownish yellow (10YR 6/6) sandy clay loam, yellow (10YR 7/6) dry; common fine distinct yellowish brown mottles and few very fine faint light brownish gray mottles; reddish stains in root channels and on some ped surfaces; weak fine subangular blocky structure; hard, friable; common fine pores; about 30 percent A2 material surrounding B material; common pockets of uncoated light grayish brown (10YR 6/2) fine sand 5 to 10 millimeters in size; very strongly acid; gradual wavy boundary.

B21t—19 to 33 inches; yellowish brown (10YR 5/8) clay, brownish yellow (10YR 6/8) dry; many fine and medium prominent red (2.5YR 4/8) mottles and few fine and medium distinct gray (10YR 6/1) mottles;

moderate coarse prismatic structure parting to moderate fine angular blocky; extremely hard, firm, sticky and plastic; continuous clay films; vertical streaks of uncoated fine sand and silt 2 millimeters thick between prism faces; very strongly acid; gradual wavy boundary.

B22tg—33 to 43 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common fine and medium distinct yellowish brown (10YR 5/8) mottles and common fine prominent red mottles; weak coarse prismatic structure parting to moderate fine angular blocky; extremely hard, firm, sticky and plastic; patchy clay films; uncoated fine sand and silt coatings on faces of prisms; strongly acid; diffuse wavy boundary.

B23tg—43 to 60 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common fine prominent red mottles and few fine distinct yellowish brown mottles; weak fine angular blocky structure; extremely hard, firm, sticky and plastic; patchy clay films; medium acid.

The Ap horizon is 3 to 8 inches thick. It is very dark grayish brown, dark grayish brown, grayish brown, dark brown, or brown. It is strongly acid through slightly acid. The A&B horizon is brown, pale brown, very pale brown, yellowish brown, or light yellowish brown. Mottles are strong brown or yellowish brown. The A&B horizon is sandy loam, fine sandy loam, or very fine sandy loam. It is strongly acid through slightly acid. The B & A horizon is yellowish brown, light yellowish brown, or brownish yellow. Mottles are red, yellowish red, strong brown, light brownish gray, or light gray. The B&A horizon is clay loam, silty clay loam, or sandy clay loam. It is very strongly acid through medium acid. The B2t horizon is clay loam, silty clay loam, sandy clay, or clay. It is very strongly acid through medium acid. The matrix in the upper part of the B2t horizon is strong brown, yellowish brown, or brownish yellow. It contains mottles of red, gray, light brownish gray, or light gray. The matrix in the lower part of the B2t horizon is gray, light brownish gray, or light gray. Mottles are red, strong brown, yellowish brown, or brownish yellow. In a few places horizons below a depth of 50 inches contain a few pitted calcium carbonate concretions.

**Beaumont Series**

The Beaumont series consists of deep, acid, nearly level, clayey soils on upland prairies. These soils formed in thick beds of alkaline marine clay.

Undisturbed areas of these soils have gilgai microrelief, in which the microknolls are 6 to 12 inches higher than the microdepressions. When these soils are dry they have deep, wide cracks that extend to the surface. During rainstorms, water enters the cracks rapidly. When the soils are wet and the cracks are closed, water moves very slowly into the soil. Beaumont soils are poorly drained. Surface runoff and internal drainage are very slow. Permeability is very slow, and the available water capacity is high.

Some of these soils are used for rice and pasture plants. Pine and hardwood trees have encroached in a few areas. Some areas are covered by buildings and other urban structures.

Representative profile of Beaumont clay, in pasture, in the center of a microdepression, from the intersection of Red Bluff Road and Bay Area Boulevard (about 4 miles northeast of Clear Lake City), 1.0 mile northwest along Red Bluff Road, 1.35 miles north on the service road along the east side of Big Island Slough to the intersection with a pipeline, 0.3 mile east along the pipeline, and 100 feet south:

A11—0 to 9 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; common fine and medium distinct mottles of dark reddish brown (5YR 3/3); reddish brown (5YR 4/4) stains along root channels and on ped faces; moderate medium angular blocky structure; very hard, very firm, very sticky and plastic; many fine roots; common pressure faces; common black masses of partly decomposed organic matter; few shotlike iron-manganese concretions; very strongly acid; clear smooth boundary.

A12—9 to 21 inches; gray (10YR 5/1) clay, gray (10YR 6/1) dry; common fine and medium distinct dark brown (7.5YR 4/4) stains along root channels and on ped faces; moderate medium angular blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; many shiny pressure faces; few worm casts; few black organic stains; few fine iron-manganese concretions; very strongly acid; gradual wavy boundary.

AC1g—21 to 43 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; many fine and medium distinct mottles of dark brown (7.5YR 4/4); many ped faces coated with gray (10YR 5/1) clay; distinct parallelepipeds parting to moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common coarse intersecting slickensides; many shiny pressure faces; dark brown stains along root channels; few fine iron-manganese concretions; common cracks 3 to 4 centimeters wide filled with gray (10YR 5/1) clayey material; very strongly acid; diffuse wavy boundary.

AC2g—43 to 59 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common fine distinct mottles of dark yellowish brown; distinct parallelepipeds parting to moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; common coarse intersecting slickensides; common shiny pressure faces; few fine iron-manganese concretions; strongly acid; gradual wavy boundary.

Cg—59 to 73 inches; grayish brown (2.5Y 5/2) clay, light brownish gray (2.5Y 6/2) dry; common fine faint mottles of light olive brown and few fine distinct mottles of strong brown; weak coarse angular blocky structure; extremely hard, very firm, very sticky and plastic; few slickensides; neutral.

The A horizon is 10 to 25 inches thick. It is very dark gray, dark gray, or gray. Mottles are dark reddish brown, reddish brown, dark brown, yellowish brown, or light olive brown. The A horizon is very strongly acid through slightly acid. The ACg horizon is dark gray, gray, or light gray. Mottles are reddish brown, dark brown, dark yellowish brown, strong brown, yellowish brown, or brownish yellow. The ACg horizon is clay or silty clay. It is very strongly acid through medium acid. The Cg horizon is gray, light gray, grayish brown, or light brownish gray. Mottles are yellow or brown. The Cg horizon is clay or silty clay. It is strongly acid through mildly alkaline. In a few places calcium carbonate concretions are below a depth of 65 inches.

**Bernard Series**

The Bernard series consists of deep, neutral, nearly level to gently sloping, loamy soils on upland prairies. These soils have a loamy surface layer about 6 inches thick underlain by clayey lower layers (fig. 7). They formed in clayey unconsolidated sediments.

These soils are somewhat poorly drained. Surface runoff is very slow. Internal drainage is slow to very slow. Permeability is very slow, and the available water capacity is high.

These soils are used mainly for row crops, improved pasture, and native pasture. A large area is covered by buildings and other urban structures.

Representative profile of Bernard clay loam, in a field, from intersection of Cook Road and Alief Road in Alief, 1.11 miles west along Alief Road, 0.96 mile south on Synott Road, and 80 feet west:

Ap—0 to 6 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; moderate medium granular structure; very hard, friable; many fine roots; common fine pores; common worm casts; few shotlike iron-manganese concretions; neutral; clear smooth boundary.

B1g—6 to 18 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; very hard, firm; common fine roots; common fine pores; patchy clay films; few shotlike iron-manganese concretions; neutral; gradual wavy boundary.

B21tg—18 to 34 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium and coarse blocky structure; few slickensides that do not intersect; extremely hard, very firm, sticky and plastic; few very fine pores; clay films on ped surfaces; few shotlike iron-manganese concretions; mildly alkaline; noncalcareous in matrix; diffuse wavy boundary.

B22tg—34 to 54 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; few fine distinct yellowish brown mottles mainly surrounding iron-manganese and calcium carbonate concretions; weak coarse blocky structure; a few slickensides that do not intersect; extremely hard, very firm, sticky and plastic; few patchy clay films; few shotlike iron-manganese concretions; few irregularly shaped calcium carbonate concretions that have pitted surfaces and that are mainly less than 1 centimeter in size; moderately alkaline; noncalcareous in matrix; gradual wavy boundary.

B3g—54 to 65 inches; gray (5Y 5/1) clay, light gray (5Y 6/1) dry; common vertical streaks of dark gray (10YR 4/1) and few fine distinct yellowish brown and strong brown mottles; massive; very hard, firm, sticky and plastic; few shotlike iron-manganese concretions; about 5 to 7 percent calcium carbonate concretions less than 3 centimeters in size that are irregularly shaped and have pitted surfaces; moderately alkaline, noncalcareous in matrix.

The Ap horizon is 3 to 8 inches thick. It is black, very dark gray or very dark grayish brown and is slightly acid through moderately alkaline. The B1g horizon is the same color as the A horizon. It is clay, clay loam, or silty clay loam that is more than 35 percent clay. It is neutral through moderately alkaline. The B2tg horizon is black, very dark gray, dark gray, gray, very dark grayish brown, dark olive gray, dark grayish brown, olive gray, or grayish brown. It has mottles of yellow or brown. It is clay or silty clay, and is mildly alkaline through moderately alkaline. The B3g horizon is gray, light gray, grayish brown, light brownish gray, olive gray, or light olive gray. It is mottled with yellow, brown, or olive in most places. It is clay, clay loam, or silty clay loam.

**Bissonnet Series**

The Bissonnet series consists of deep, nearly level, loamy soils on forested uplands. The loamy upper layers of these soils tongue into the more clayey lower layers (fig. 8). These soils formed in thick beds of unconsolidated clay and clay loam sediments.

These soils are somewhat poorly drained. During some wet seasons, they have a perched water table and the lower layers are saturated for 1 to 4 months. Surface runoff and permeability are slow and the available water capacity is high.

Most of these soils are in pine and hardwood trees. Woodland grazing is the main use. A few areas have been cleared and are used for improved pasture and cultivated crops.

Representative profile of Bissonnet very fine sandy loam, in timber, from the intersection of Farm Roads 1960 and 2100 in Huffman, 3.4 miles south along Farm Road 2100, 1.72 miles west on Indian Shores Road, and 400 feet south:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) very fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable; few fine roots; common fine pores; common worm casts; very strongly acid; clear wavy boundary.

A21—6 to 24 inches; brown (10YR 5/3) very fine sandy loam, very pale brown (10YR 7/3) dry; few fine faint yellowish brown mottles and strong brown stains; many sand and silt grains are uncoated; weak fine granular structure; slightly hard, friable; few fine roots; few fine pores; few worm casts; very strongly acid; clear wavy boundary.

A22—24 to 28 inches; pale brown (10YR 6/3) very fine sandy loam, very pale brown (10YR 7/3) dry; few fine faint yellowish brown mottles; many sand

and silt grains are uncoated; weak fine granular structure; slightly hard, friable; few fine roots; few fine pores; few worm casts; very strongly acid; clear smooth boundary.

B&A—28 to 32 inches; light brownish gray (10YR 6/2) sandy clay loam, light gray (10YR 7/2) dry; common fine distinct mottles of yellowish brown, strong brown, and red; 15 to 30 percent light gray (10YR 7/2) very fine sandy loam surrounding isolated bodies of more clayey Bt material; weak medium subangular blocky structure; hard, friable; few fine roots; few fine pores, some lined with clay; reddish stains in old root channels; few clay films on surfaces of some peds; few black concretions; many uncoated sand grains; very strongly acid; clear irregular boundary.

B21tg—32 to 42 inches; gray (10YR 6/1) clay loam, light gray (10YR 7/1) dry; common medium prominent red (2.5YR 4/6) mottles and common fine distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few fine roots; few fine pores; discontinuous clay films on faces of peds; some ped surfaces covered with uncoated fine sand and silt grains; very strongly acid; gradual boundary.

B22tg—42 to 70 inches; gray (10YR 6/1) clay loam, light gray (10YR 7/1) dry; common medium distinct yellowish brown (10YR 5/6) mottles and few fine prominent red mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; discontinuous clay films on faces of peds; some surfaces of peds covered with uncoated fine sand and silt grains; some organic staining on faces of prisms; mildly alkaline in lower part of horizon; noncalcareous.

The A horizon is 20 to 40 inches thick. It is very strongly acid through medium acid. The Al horizon is dark gray, dark grayish brown, gray, grayish brown, or brown. The A2 horizon is grayish brown, brown, light brownish gray, pale brown, or light yellowish brown. Some profiles have mottles of strong brown, brownish yellow, or yellowish brown in the A2 horizon. The B&A horizon is light brownish gray, pale brown, brown, yellowish brown, or light yellowish brown. It is sandy clay loam, loam, or silty loam. The B&A horizon has mottles of strong brown, yellowish brown, or red. It is very strongly acid through medium acid. The B2t horizon is gray, light brownish gray, or light gray. Mottles are brownish yellow, yellowish brown, strong brown, or red. The B2t horizon is clay loam, sandy clay loam, or silty clay loam. It is very strongly acid through slightly acid in the upper part. It ranges to mildly alkaline in the lower part in some places.

**Boy series**

The Boy series consists of deep, acid, nearly level to gently sloping, sandy soils in forest. These soils formed in unconsolidated beds of sand, loamy sand, and loam.

These soils are somewhat poorly drained. During wet periods they are saturated for 2 to 4 months in the layer containing plinthite and the soil just above it. Surface runoff is very slow, and in places it is not a hazard at all. Internal drainage and permeability are rapid above the layer containing plinthite, and permeability is moderately slow in the layer containing plinthite. The available water capacity is low.

Most of these soils are in pine and hardwood trees. Timber production and woodland grazing are the main uses. A few areas have been cleared and are used for improved pasture.

Representative profile of Boy loamy fine sand, in timber, from intersection of U.S. Highway 59 and Farm Road 1960 in Humble, 8 miles east along Farm Road 1960, 2.33 miles northwest on private gravel road (entrance to Atascosa Country Club), and 100 feet north:

A11—0 to 5 inches; dark gray (10YR 4/1) loamy fine sand, gray (10YR 5/1) dry; weak fine granular structure; slightly hard, very friable; common tree roots; slightly acid; clear smooth boundary.

A12—5 to 9 inches; grayish brown (10YR 5/2) fine sand, light brownish gray (10YR 6/2) dry; few fine faint yellowish brown (10YR 5/4) mottles; single grained; loose, very friable; many tree roots; strongly acid; clear smooth boundary.

A21—9 to 37 inches; light yellowish brown (10YR 6/4) fine sand, very pale brown (10YR 7/3) dry; few fine faint yellowish brown (10YR 5/4) mottles; single grained; loose, very friable; many tree roots; medium acid; gradual smooth boundary.

A22—37 to 56 inches; very pale brown (10YR 7/4) fine sand, very pale brown (10YR 8/3) dry; few fine faint yellowish brown (10YR 5/4) mottles; single grained; loose, very friable; few tree roots; medium acid; clear smooth boundary.

B2tg—56 to 75 inches; light brownish gray (10YR 6/2) sandy clay loam, light gray (10YR 7/2) dry; common medium distinct strong brown (7.5YR 5/6) mottles and common fine distinct red (2.5YR 4/6) mottles; weak fine and medium subangular blocky structure; hard, friable; few patchy clay films; about 10 percent plinthite by volume; very strongly acid.

The A horizon is 35 to 68 inches thick. It is loamy fine sand or fine sand. It is very strongly acid through slightly acid. The Al horizon is dark gray, gray, light gray, dark grayish brown, grayish brown, light brownish gray, brown, or pale brown. Mottles in the Al horizon are yellowish brown, light yellowish brown, or brownish yellow. The A2 horizon is light gray, white, light brownish gray, very pale brown, pale brown, or light yellowish brown. Mottles in the A2 horizon are yellowish brown or light brown. The B2tg horizon is gray, grayish brown, light brownish gray, light gray, or white. Mottles in the B2tg horizon are red, strong brown, reddish yellow, yellowish brown, or brownish yellow. The B2tg horizon is fine sandy loam, sandy loam, or sandy clay loam. It is very strongly acid through medium acid and is 5 to 20 percent plinthite.

**Clodine series**

The Clodine series consists of deep, nearly level, loamy soils on upland prairies. These soils formed in calcareous, loamy sediments and have calcium carbonate concretions with pitted surfaces at a depth of more than 29 inches (fig. 9).

These soils are poorly drained. They are saturated for 3 to 6 months in winter and early in spring. Surface runoff is very slow. Internal drainage is slow. Permeability is moderate. The available water capacity is high.

These soils are used for pasture and cultivated crops.

Representative profile of Clodine loam, in pasture, from the main terminal building of the Houston Intercontinental Airport, 2.8 miles south along John F. Kennedy Boulevard, 0.38 mile east along Greens Road, 0.53 mile north on an unimproved road, and 60 feet east:

Ap—0 to 6 inches; dark gray (10YR 4/1) loam, gray (10YR 5/1) dry; weak fine subangular blocky structure; slightly hard, friable; common fine grass roots; common worm casts; some fine sand grain sorting due to plowing; neutral; clear wavy boundary.

A12—6 to 12 inches; dark gray (10YR 4/1) loam, gray (10YR 5/1) dry; weak fine subangular blocky structure; slightly hard, friable; common worm casts; very fine sand grains on ped faces; moderately alkaline; gradual wavy boundary.

B21tg—12 to 29 inches; gray (10YR 5/1) loam, gray (10YR 6/1) dry; few fine faint yellowish brown mottles; weak medium subangular blocky structure; hard, friable; few fine roots; patchy clay films on ped faces; uncoated sand grains on ped faces; 10 to 15 percent crayfish krotovinas filled with dark gray (10YR 4/1) material; few shot like iron-manganese concretions; moderately alkaline; gradual wavy boundary.

B22tg—29 to 51 inches; light brownish gray (2.5Y 6/2) loam, light gray (2.5Y 7/2) dry; common fine faint yellow mottles; weak medium subangular blocky structure; very hard, friable; common fine pores; 15 percent by volume irregularly shaped pitted calcium carbonate concretions 1 to 4 centimeters in diameter; concretions are surrounded by brownish yellow (10YR 6/8); common fine streaks of gray (10YR 5/1) material throughout horizon; 5 to 10 percent crayfish krotovinas filled with dark gray (10YR 4/1) material; patchy clay films; few fine iron-manganese concretions; moderately alkaline; gradual wavy boundary.

B23tg—51 to 72 inches; light brownish gray (2.5Y 6/2) loam, light gray (2.5Y 7/2) dry; common fine and medium distinct brownish yellow (10YR 6/8) mottles; moderate medium subangular blocky structure; very hard, friable; common fine pores; 10 percent by volume irregularly shaped pitted calcium carbonate concretions 1 to 4 centimeters in diameter; common fine streaks of gray (10YR 5/1) material; few iron-manganese concretions 5 to 15 millimeters in diameter; moderately alkaline.

The A horizon is 8 to 20 inches thick. It is dark gray or gray. In a few places the A horizon is less than 6 inches thick, and it is very dark gray in the upper part. It is slightly acid through moderately alkaline. The B2tg horizon is gray, light gray, or light brownish gray. Most profiles have few or common mottles of yellow, brown, or gray. The B2tg horizon is loam, clay loam, or sandy clay loam. It is neutral through moderately alkaline. The soil matrix is noncalcareous, but calcium carbonate concretions make up 2 to 15 percent, by volume, of some horizons between depths of 20 and 60 inches.

### Edna series

The Edna series consists of deep, nearly level to gently sloping soils on upland prairies. These soils are in low flat areas and on pimple mounds, mainly in association with other soils including Bernard soils (fig. 10). They formed in thick loamy and clayey unconsolidated sediments of marine origin.

These soils are poorly drained. They are saturated for long periods, especially during winter and spring. Surface runoff is very slow. Permeability is very slow, and the available water capacity is high.

These soils are used mainly for rice, for native pasture, and for beef cattle.

Representative profile of Edna fine sandy loam, in pasture, from the intersection of Interstate Highway 10 and Texas Highway 6 in Addicks, 3.2 miles south along Texas Highway 6, 0.4 mile west along Farm Road 1093, 1.35 miles west on Beeler Road, and 75 feet south:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; few fine distinct yellowish brown mottles; massive; very hard, friable; common fine roots; many streaks and pockets of brown (10YR 5/3) sandy material; few streaks of dark gray (10YR 4/1) clayey material; few worm casts; neutral; abrupt smooth boundary.

B21tg—5 to 20 inches; gray (5Y 5/1) clay, gray (5Y 6/1) dry; few fine prominent yellowish red mottles; common fine distinct yellowish brown mottles; moderate medium and coarse angular blocky structure; extremely hard, very firm; few fine roots; continuous clay films; few streaks and fine pockets of very pale brown (10YR 7/3) loamy sand; ped faces coated with fine sand in upper 3 inches; few crayfish krotovinas filled with grayish brown (10YR 5/2) sandy material; common pressure faces; moderately alkaline; gradual wavy boundary.

B22tg—20 to 41 inches; olive gray (5Y 5/2) clay, light olive gray (5Y 6/2) dry; many fine and medium distinct light olive brown (2.5Y 5/4) mottles; common fine gray (5Y 5/1) streaks; moderate medium and coarse angular blocky structure; extremely hard, very firm; few streaks of sandy material on ped faces; common pressure faces; continuous clay films; few crayfish krotovinas lined with clayey dark gray (10YR 4/1) material; 2 percent by volume large pitted calcium carbonate concretions with hollow centers; few slickensides that do not intersect; moderately alkaline; gradual wavy boundary.

B3g—41 to 72 inches; gray (5Y 6/1) sandy clay loam, light gray (5Y 7/1) dry; many fine and medium distinct yellowish brown (10YR 5/8) mottles; ped coatings are gray (5Y 5/1); moderate medium and coarse subangular blocky structure; very hard, firm; patchy clay films; very pale brown (10YR 7/3) sandy coatings between peds; few iron-manganese concretions; few pitted calcium carbonate concretions with hollow centers and few soft calcium carbonate concretions; few crayfish krotovinas; moderately alkaline.

The A horizon is 4 to 10 inches thick in most places but ranges to about 18 inches, mainly on pimple mounds. The A horizon is dark gray, gray, dark grayish brown, grayish brown, light brownish gray, olive gray, or light olive gray. It is medium acid through neutral. The B2tg horizon is dark gray, gray, dark grayish brown, grayish brown, light brownish gray, dark gray, light olive gray, or light gray. It has yellowish brown, brown, yellowish red, or light olive brown mottles. The B2tg horizon is clay, silty clay, or heavy clay loam. It is slightly acid through moderately alkaline. The B3g horizon may be the color of any of the horizons above it. It is clay loam, sandy clay loam, or silty clay loam and is neutral through moderately alkaline.

### Gessner series

The Gessner series consists of deep, slightly acid to moderately alkaline, nearly level, loamy soils. These soils are in low depressions of the coastal prairie. They are loamy throughout (fig. 11), and they formed in thick beds of unconsolidated loamy sediment.

These soils are poorly drained. Surface runoff is very slow to ponded. The soils are saturated, with water during winter and spring and for short periods following summer rains. Water stands on the surface in the depressions for long periods. Internal drainage is slow. Permeability is moderate, and the available water capacity is high.

These soils are mainly in native pasture. Some are used for rice, and some are in urban development.

Representative profile of Gessner loam, about 19 miles north from downtown Houston along Interstate Highway 45 to Farm Road 1960, 2 miles south along Interstate Highway 45 access road, and 75 feet east:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; few fine faint yellowish brown stains around root channels; weak fine granular structure; hard, friable; many fine roots; common fine pores; common worm casts; few fine soft iron-manganese masses; few fine pockets and vertical streaks of uncoated fine sand grains; slightly acid; clear wavy boundary.

A2g—7 to 16 inches; grayish brown (10YR 5/2) loam, light brownish gray (10YR 6/2) dry; common fine faint brown stains mostly around root channels; weak fine granular structure; hard, friable; few fine roots; many fine pores; common worm casts; few fine soft iron-manganese masses; common crayfish krotovinas filled with concave strata of loam and uncoated fine sand; few pockets of Btg material; slightly acid; clear irregular boundary.

Bg&Ag—16 to 34 inches; dark gray (10YR 4/1) loam, gray (10YR 5/1) dry; few fine faint yellowish brown and brown mottles; weak coarse prismatic structure parting to weak fine subangular blocky structure; very hard, friable; common iron-manganese concretions 2 to 10 millimeters in diameter; prism faces surrounded with uncoated fine sand grains 1 centimeter or less thick; about 30 percent grayish brown (10YR 5/2) A2g material; few tongues of silt loam and fine sand; about 10 percent crayfish krotovinas; krotovina walls coated with a layer of dark gray clay about 1 millimeter thick; neutral; gradual irregular boundary.

B21tg—34 to 53 inches; light brownish gray (10YR 6/2) loam, light gray (10YR 7/2) dry; few fine faint mottles of yellowish brown; weak coarse prismatic structure parting to weak fine subangular blocky; very hard, friable; few fine roots; few fine pores; few patchy clay films; few soft iron-manganese masses; prism faces covered with uncoated fine sand; few tongues less than 2 centimeters wide and tapered at the bottom; about 8 percent crayfish krotovinas filled with silt loam and uncoated fine sand; krotovina walls coated with dark grayish brown clay about 1 millimeter thick; bottoms of krotovinas have dark gray clay coatings about 10 millimeters thick; moderately alkaline; gradual irregular boundary.

B22tg—53 to 84 inches, light gray (10YR 7/2) loam, white (10YR 8/2) dry; common medium distinct mottles of yellowish brown (10YR 5/8) and brownish yellow (10YR 6/8); weak coarse prismatic structure parting to weak coarse subangular blocky; very hard, friable; few fine roots; few fine pores; few patchy clay films; few fine soft iron-manganese masses; gray (10YR 5/1) streaks mainly in root channels; uncoated fine sand grains on prism faces; 15 percent crayfish krotovinas filled with silt loam, loam, and fine sand; moderately alkaline.

The A horizon is slightly acid through mildly alkaline and is 15 to 30 inches thick. The A1 horizon is dark gray, gray, dark grayish brown, grayish brown, or light brownish gray and is mottled with brown or yellowish brown in some places. The A2g horizon has crayfish krotovinas and streaks of uncoated fine sand and silt that tongue into the Btg horizon. The Btg horizon is dark gray, gray, light gray, grayish brown, or light brownish gray. It is mottled with brown, strong brown, yellowish brown, brownish yellow, or red. The Btg horizon is loam, sandy clay loam, or clay loam. It is neutral through moderately alkaline.

**Harris series**

The Harris series consists of deep, moderately alkaline, nearly level, clayey soils on coastal marshlands. The surface of these soils is subject to inundation by high tide-waters. These soils formed in saline, clayey coastal sediments.

These soils are very poorly drained. Surface runoff and internal drainage are very slow. Permeability is very slow. A permanent water table fluctuates between the surface and a depth of about 50 inches. The available water capacity is low.

These soils are used mainly for pasture and wildlife habitat.

Representative profile of Harris clay, on a tidal flat, from the intersection of Texas Highway 146 and East Texas Avenue in Baytown, 0.3 mile east along East Texas Avenue, 3.55 miles southeast along Tri-Cities Beach Road, 1,100 feet southwest along private road, and 100 feet east:

A11g—0 to 4 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and plastic; many grass roots and much partly decomposed organic matter; root channels stained strong brown; moderately alkaline; clear smooth boundary.

A12g—4 to 11 inches; black (N 2/ ) clay, very dark gray (N 3/ ) dry; many strong brown (7.5YR 5/6) stains on ped faces and in root channels; moderate fine and medium angular blocky structure; very hard, very firm, very sticky and plastic; many grass roots, many shiny pressure faces; many iron-manganese concretions; moderately alkaline; clear smooth boundary.

A13g—11 to 20 inches, black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate fine and medium angular blocky structure; very hard, very firm, very sticky and plastic; few fine roots; common shiny pressure faces; few strong brown stains along root channels; few iron-manganese concretions; moderately alkaline; gradual wavy boundary.

B21g—20 to 32 inches; dark gray (5Y 4/1) clay, gray (5Y 5/1) dry; moderate fine and medium angular blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few shiny pressure faces; few fine iron-manganese concretions, moderately alkaline; diffuse wavy boundary.

B22g—32 to 45 inches; gray (5Y 5/1) clay, gray (5Y 6/1) dry; common fine faint olive gray mottles; few fine distinct strong brown mottles mostly surrounding iron-manganese concretions; massive; very hard, very firm, very sticky and plastic; few shell fragments; common calcium carbonate concretions 2 to 5 millimeters in diameter increasing with depth; moderately alkaline; calcareous; diffuse wavy boundary.

Cg—45 to 64 inches; gray (5Y 6/1) clay, light gray (5Y 7/1) dry; massive; very hard, very firm, very sticky and plastic; common streaks of dark gray (5Y 4/1) clayey material; common fine calcium carbonate concretions; few soft masses of calcium carbonate; few fine iron-manganese concretions; moderately alkaline; calcareous.

The soil is saturated to the surface for extended periods, and moisture is rarely below field capacity. In most areas the surface is subject to inundation by tidewaters. Salinity ranges from strong to slight and reaction from neutral through strongly alkaline. Organic matter is on the surface or is in the upper part of the A1g horizon in most places. The A1g horizon is 12 to 24 inches thick. It is black or very dark gray. The B2g horizon is dark gray, gray, or light gray. It is clay or silty clay. The Cg horizon is generally within the same color range as the B2g horizon. It is clay or silty clay. In a few places the Cg horizon is replaced by reddish brown or dark brown buried horizons.

**Hatliff series**

The Hatliff series consists of nearly level, loamy soils that have underlying strata of sandy material. These soils occupy flood plains along streams in forested areas. They formed in deep loamy and sandy alluvial sediments.

These soils are generally flooded a few times each year. They are saturated for a few days to a few weeks mainly during winter and early in spring. These soils are moderately well drained. Surface runoff is slow. Permeability is moderately rapid, and the available water capacity is low.

These soils are used mainly for woodland grazing, timber production, and wildlife habitat.

Representative profile of Hatliff loam, in timber, from the intersection of U.S. Highway 59 and Farm Road 1960 in Humble, 900 feet northeast along U.S. Highway 59, 1.9 miles northwest on road leading to a gas well, and 100 feet west:

Ap—0 to 5 inches; dark brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; few fine faint dark gray mottles; common fine distinct strong brown stains in root channels and on ped surfaces; weak fine subangular blocky structure; hard, friable; common fine and medium roots; few worm casts; medium acid; abrupt smooth boundary.

A1—5 to 10 inches; brown (10YR 5/3) fine sandy loam, very pale brown (10YR 7/3) dry; common fine faint dark gray (10YR 4/1) mottles and common fine distinct strong brown mottles; few strong brown stains in root channels; weak fine subangular blocky structure; hard, friable; common fine and medium roots; strongly acid; abrupt smooth boundary.

C1—10 to 26 inches; yellowish brown (10YR 5/4) fine sandy loam; few medium distinct strong brown mottles and few fine faint light brownish gray mottles; few strong brown stains in root channels; common strata, 1 to 5 centimeters thick, of light yellowish brown (10YR 6/4) loamy fine sand; bedding planes evident; massive; slightly hard, very friable; strongly acid; abrupt smooth boundary.

C2—26 to 38 inches; very pale brown (10YR 7/4) loamy fine sand; few fine faint brownish yellow mottles; few strata, 5 to 10 millimeters thick, of brown (10YR 5/3) fine sandy loam; single grained; loose, very friable; medium acid; abrupt smooth boundary.

C3—38 to 70 inches; very pale brown (10YR 7/4) loamy fine sand, common strata, 1 to 3 centimeters thick, of light brownish gray (10YR 6/2) fine sandy loam; fine sandy loam strata in root channels have few fine distinct yellowish brown mottles and strong brown stains; single grained; loose, very friable; slightly acid; abrupt smooth boundary.

C4—70 to 80 inches; very pale brown (10YR 7/4) sand; common fine distinct brownish yellow mottles; single grained; loose; neutral.

Reaction ranges from strongly acid through neutral and is medium acid through neutral between depths of 10 and 40 inches. Bedding planes are evident, and strata of contrasting textures are throughout the soil. The A horizon is 6 to 14 inches thick. It is loam or fine sandy loam and is very dark gray, dark gray, gray, very dark grayish brown, dark grayish brown, grayish brown, light brownish gray, dark brown, brown, or pale brown. The A horizon also has strong brown or yellowish brown mottles or stains in the root channels. The C horizon is grayish brown, light brownish gray, light gray, white, brown, pale brown, very pale brown, yellowish brown, or light yellowish brown. Mottles are grayish brown, brownish gray, dark gray, dark grayish brown, strong brown, brownish yellow, or any of the matrix colors. The C horizon is fine sandy loam, sandy loam, loamy fine sand, loamy sand, fine sand, or sand.

**Hockley series**

The Hockley series consists of deep, acid, nearly level to gently sloping, loamy soils on forested uplands. These soils have loamy upper layers and sandy clay loam lower layers that contain plinthite (fig. 12). They formed in thick beds of unconsolidated loamy sediments.

The soils are moderately well drained. Surface runoff is medium to slow. Internal drainage is moderately slow in the layers containing plinthite and medium above the plinthite. Permeability is moderately slow, and the available water capacity is medium.

These soils are used mainly for woodland grazing, timber production, and improved pasture.

Representative profile of Hockley fine sandy loam, 0 to 1 percent slopes, in pasture, from intersection of Farm Roads 149 and 2920 in Tomball, 8.1 miles west along Farm Road 2920 (Tomball-Waller Road), and 50 feet south:

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; hard, very friable; many fine pores; many worm casts; medium acid; gradual smooth boundary.

A2—5 to 23 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak coarse subangular blocky structure; hard, very friable; few very fine pores; medium acid; gradual smooth boundary.

B21t—23 to 50 inches; yellowish brown (10YR 5/6) sandy clay loam; few to common fine and medium prominent red (2.5YR 4/6) mottles that are mainly plinthite; common medium faint brown mottles; weak medium and coarse subangular blocky structure; very hard, friable; few patchy clay films; clay bridges between sand grains; 15 percent ironstone pebbles mainly less than 2 centimeters in diameter; medium acid; gradual wavy boundary.

B22t—50 to 75 inches; reticulately mottled red (2.5YR 4/6), yellowish brown (10YR 5/6), and gray (10YR 6/1) sandy clay loam; weak and moderate medium subangular blocky structure; extremely hard, friable; patchy prominently gray clay films; 25 percent red mottles of brittle plinthite; 35 percent ironstone pebbles mainly less than 2 centimeters in diameter; slightly acid; diffuse wavy boundary.

B23t—75 to 100 inches; reticulately mottled red (2.5YR 4/6), yellowish brown (10YR 5/G), and gray (10YR 6/1) sandy clay loam; medium subangular blocky structure; extremely hard, friable; patchy clay films; 20 percent red mottles of brittle plinthite; 15 percent iron-stone pebbles, decreasing with depth; slightly acid.

The A horizon is 20 to 40 inches thick. It is strongly acid through slightly acid. The Ap horizon is dark brown, brown, very dark grayish brown, dark grayish brown, or grayish brown. Where the Ap horizon is dark brown or very dark grayish brown, it is less than 6 inches thick. The A2 horizon is dark grayish brown, grayish brown, brown, or pale brown. The B2t horizon is loam, clay loam, or sandy clay loam. It is slightly acid through strongly acid. Ironstone pebbles make up 5 to 35 percent, by volume, of the B2t horizon. The B21t horizon is yellowish brown, brownish yellow, or yellow. Mottles are red, yellowish red, brown, or strong brown. The B22t and B23t horizons are reticulately and coarsely mottled red, yellowish brown, and gray or mottled red and gray. Some profiles also have mottles of dark red, yellowish red, reddish yellow, or light gray.

**Ijam series**

The Ijam series consists of moderately alkaline, nearly level, clayey soils on coastal flats. These soils formed in alkaline to saline clayey sediment that was dredged or pumped from the floods of rivers, bayous, bays, or canals during the construction or maintenance of waterways.

Ijam soils are very poorly drained to ponded. The water table is at the surface during wet periods and moves to a depth of about 30 inches during dry periods. Surface runoff and permeability are very slow, and the available water capacity is medium.

These soils are not suitable for cultivation. Areas that have vegetation are used mainly for pasture.

Representative profile of Ijam clay, in a barren dredge site, from the intersection of Texas Highway 146 and East Texas Avenue in Baytown, 0.81 mile east along East Texas Avenue and 1,000 feet southwest to Roseland Park headquarters, 1,000 feet south, and 500 feet east:

A1—0 to 8 inches; dark gray (5Y 4/1) clay, gray (5Y 5/1) dry; common medium distinct mottles of olive (5Y 5/3); massive; extremely hard, very firm, sticky and plastic; moderately alkaline; noncalcareous; diffuse smooth boundary.

Cg—8 to 60 inches; gray (5Y 5/1) clay, gray (5Y 6/1) dry; few fine distinct mottles of yellowish brown; massive; extremely hard, very firm, sticky and plastic; few thin discontinuous strata of silt and very fine sand; few shell fragments; moderately alkaline; noncalcareous.

The A1 horizon is 2 to 10 inches thick. It is dark gray, gray, light gray, light brownish gray, or light olive gray. Mottles and streaks are strong brown, yellowish brown, light olive brown, olive yellow, or olive. The A1 horizon is dominantly clay but is clay loam or loam in places. It is neutral through strongly alkaline. The Cg horizon is dark gray, gray, light brownish gray, or light olive gray. Mottles and streaks are dark gray, gray, light gray, light brownish gray, or light olive gray. The Cg horizon is dominantly clay. In places it has thin discontinuous strata of clay loam, loam, silt, or very fine sand. The Cg horizon is neutral through strongly alkaline. It is calcareous in places and generally contains a few shells or shell fragments.

**Kaman series**

The Kaman series consists of deep, neutral, nearly level, clayey soils on bottom lands. These soils formed in thick beds of alkaline clayey sediments.

These soils are subject to flooding. They are poorly drained. Runoff, internal drainage, and permeability are very slow. The soils are saturated to within 30 inches of the surface during most of the year. The available water capacity is high.

These soils are used mainly for improved pasture, native pasture, and hardwood timber.

Representative profile of Kaman clay, in pasture, from the intersection of U.S. Highway 90 and Farm Road 2100 in Crosby, 3.32 miles south along Farm Road 2100, 0.6 mile west on Highway Shores Road, and 200 feet north:

A11—0 to 5 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; weak fine and medium subangular blocky structure; extremely hard, very firm, sticky and plastic; many fine roots; neutral; clear smooth boundary.

A12—5 to 24 inches; black (10YR 2/1) clay, very dark gray (10YR 4/1) dry; moderate fine and medium angular blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; many shiny pressure faces; few fine black concretions; few uncoated quartz grains between peds; neutral; diffuse wavy boundary.

A13—24 to 39 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) (dry; moderate fine and medium angular blocky structure; extremely hard, very firm, sticky and very plastic; few fine roots; many pressure faces; common slickensides that do not intersect; few uncoated quartz grains between peds; few fine black concretions; mildly alkaline; diffuse wavy boundary.

Bg—39 to 52 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) (dry; few fine faint yellowish brown mottles; moderate fine and medium angular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; common slickensides; common parallelepipeds that have long axes tilted about 30 to 40 degrees from the horizontal; few uncoated quartz grains between peds; few fine black concretions; mildly alkaline; diffuse wavy boundary.

Cg—52 to 70 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; few fine faint yellowish brown mottles; weak coarse angular blocky structure; extremely hard, very firm, sticky and very plastic; few fine calcium carbonate concretions; few fine black concretions; mildly alkaline.

The soil is medium acid through mildly alkaline and is calcareous below a depth of 24 inches in a few places. Mottles of yellowish brown and brownish yellow are common throughout the profile in some places. Clay content in the upper 40 inches is 45 to 60 percent. The A horizon is black or very dark gray. Moist values are 3.5 or less to a depth of 24 to 45 inches. Along some stream channels the soil has an overwash of loamy material up to 10 inches thick. The Bg and Cg horizons are very dark gray, dark gray, or gray. They have yellow, brown, and olive mottles in places. The texture of the Bg and Cg horizons is clay or silty clay. The Cg horizon has few to many calcium carbonate concretions.

**Katy series**

The Katy series consists of deep, acid, nearly level, loamy soils on prairies. These soils have a loamy layer about 28 inches thick over a more clayey layer (fig. 13). They formed in thick loamy and clayey unconsolidated sediments.

A water table is perched above the clay loam layer for short periods during cool months or during periods of excess rainfall. These soils are somewhat poorly drained. Surface runoff is slow to very slow. Internal drainage is slow. Permeability is very slow, and the available water capacity is high.

These soils are used mainly for rice, improved pasture, and native pasture.

Representative profile of Katy fine sandy loam, in idle rice field, from intersection of U.S. Highway 90 and Katy-Hockley Road (Avenue D) in Katy, 4.3 miles north along Katy-Hockley Road, 2 miles east along Stockdick Road, 155 feet north and 115 feet east:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; common reddish brown and yellowish red stains on ped surfaces and along root channels; few fine faint dark gray mottles, weak fine granular structure; hard, friable; many fine roots; few worm casts; few streaks of uncoated fine sand; medium acid; clear smooth boundary.

A2—10 to 28 inches; brown (10YR 5/3) fine sandy loam, pale brown (10YR 6/3) dry; few medium distinct reddish stains and common yellowish brown stains on ped surfaces and along root channels; weak fine granular structure; slightly hard, friable; common fine roots; many fine pores; many worm casts; common streaks and pockets of uncoated fine sand; medium acid; clear boundary.

B21t—28 to 50 inches; prominently mottled gray (10YR 6/1), red (2.5YR 4/6), and yellowish brown (10YR 5/6) clay loam; moderate coarse prismatic structure parting to moderate medium blocky; red mottles concentrated in the center of prisms and surrounded by yellowish brown mottles, which, in turn, are surrounded by gray; the centers of some red mottles are dark red (2.5YR 3/6); extremely hard, very firm; common fine roots mainly between ped surfaces; few fine pores; continuous thick very dark gray (10YR 3/1) clay films on ped surfaces of blocks and prisms; few reddish brown stains along root channels; few crayfish krotovinas filled with loamy material containing horizontal streaks of uncoated fine sand; slightly acid; gradual wavy boundary.

B22t—50 to 65 inches; prominently mottled light gray (10YR 6/1), strong brown (7.5YR 5/6), and red (2.5YR 4/6) clay loam; few medium distinct gray (10YR 5/1) mottles; moderate coarse prismatic structure parting to moderate coarse blocky; extremely hard, very firm; few fine roots mostly between ped faces; continuous dark gray (10YR 4/1) clay films mainly on faces of blocks; fine sandy loam coatings 1 to 5 millimeters thick on prism faces; slightly acid.

The A horizon is 18 to 30 inches thick. It is slightly acid or medium acid. The Ap horizon is dark grayish brown, grayish brown, or brown. The A2 horizon is brown, pale brown, very pale brown, yellowish brown, or light yellowish brown. Mottles of yellowish brown and gray are in the A2 horizon in some places. The B2t horizon is prominently mottled gray, grayish brown or light brownish gray, yellowish brown or strong brown, and red or yellowish red. The dark red centers of some red mottles in the lower part of the B2t horizon are plinthite. The amount of plinthite ranges from 0 to about 3 percent. Some ped faces are coated with very dark gray or dark gray in most profiles. The B2t horizon is clay loam, sandy clay loam, or clay. Clay makes up 25 to 35 percent of the control section. The B2t horizon is strongly acid through neutral. Some profiles are moderately alkaline below a depth of 50 inches.

**Kenney series**

The Kenney series consists of deep, acid, nearly level to gently sloping, sandy soils on forested uplands. These soils have a thick sandy layer underlain by a reddish loamy layer (fig. 14). They formed in thick beds of unconsolidated sediment of loamy sand, sandy loam, and sandy clay loam.

Kenney soils are well drained. Surface runoff is very slow. Internal drainage is rapid. Permeability is moderately rapid, and the available water capacity is low.

These soils are used mainly for woodland grazing. A few areas are used for timber, improved pasture, and cultivated crops.

Representative profile of Kenney loamy fine sand, in timber, from the intersection of Interstate Highway 45 and Spring-Stuebner Road in Spring, 3.3 miles west along Spring-Stuebner Road, 1.8 miles north on Rothwood Road, and 40 feet west:

A11—0 to 5 inches; dark grayish brown (10YR 4/2) loamy fine sand, grayish brown (10YR 5/2) dry; single grained; loose, very friable; many fine grass roots; common tree roots; slightly acid; clear smooth boundary.

A12—5 to 9 inches; dark brown (10YR 4/3) loamy fine sand, brown (10YR 5/3) dry; single grained; loose, very friable; common fine grass roots; common tree roots; slightly acid; clear smooth boundary.

A2—9 to 56 inches; light yellowish brown (10YR 6/4) loamy fine sand, very pale brown (10YR 7/4) dry; single grained; loose, very friable; few fine roots; few fine reddish brown lamellae 1 to 2 millimeters thick in lower part of horizon; medium acid; clear wavy boundary.

B2t—56 to 80 inches; strong brown (7.5YR 5/6) sandy clay loam, reddish yellow (7.5YR 6/6) dry; few fine and medium distinct yellowish red (5YR 4/8) mottles, few fine faint light brown mottles; weak fine and medium subangular blocky structure; hard, friable; few fine roots; strongly acid.

The A horizon is 40 to 72 inches thick. It is strongly acid through neutral. The Al horizon is dark grayish brown, grayish brown, light brownish gray, dark brown, brown, or pale brown. The A2 horizon is light brownish gray, brown, pale brown, very pale brown, light brown, or light yellowish brown. A few discontinuous dark brown or reddish brown lamellae 2 to 5 millimeters thick are in the A2 horizon in some places. The B2t horizon is red, yellowish red, strong brown, or yellowish brown. Mottles of red, brown, and yellow are in the B2t horizon in some places. The B2t horizon is fine sandy loam, sandy clay loam, or clay loam. It is very strongly acid to slightly acid. In a few places, plinthite is in the upper part of the B2t horizon and the plinthite makes up less than 4 percent of the soil.

**Lake Charles series**

The Lake Charles series consists of deep, neutral, nearly level to gently sloping, clayey soils on upland prairies. These soils are clayey throughout the profile and have wide deep cracks and intersecting slickensides (fig. 15). They formed in alkaline marine clay.

Undisturbed areas of these soils have gilgai microrelief, in which the microknolls are 6 to 12 inches higher than the microdepressions. When these soils are dry, deep, wide cracks form on the surface. Water enters the cracks rapidly, but when the soils are wet and the cracks are sealed, water enters very slowly. These soils are somewhat poorly drained. Surface runoff is very slow or medium. Internal drainage is very slow. Permeability is very slow, and the available water capacity is high.

These soils are used mainly for rice and pasture. Some are in urban uses.

Representative profile of Lake Charles clay, 0 to 1 percent slopes, at the center of a microdepression, in pasture, from the intersection of Cook Road and Alief Road in Alief, 1.11 miles west along Alief Road, 1.37 miles north on Synott Road, and 75 feet west:

Ap—0 to 22 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate fine blocky structure; very hard, very firm, very sticky and plastic; many fine roots; few fine iron-manganese concretions; shiny pressure faces; neutral; diffuse wavy boundary.

A12—22 to 36 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate fine blocky and subangular blocky structure in upper 12 inches and breaking to moderate fine and medium blocky in the lower part; the lower part contains common large wedge-shaped peds having long axes tilted 10 to 60 degrees from the horizontal and bordered by intersecting slickensides; extremely hard, very firm, very sticky and plastic; aggregates have shiny pressure faces; few fine iron-manganese and calcium carbonate concretions; mildly alkaline; diffuse wavy boundary.

AC1g—36 to 52 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; common fine and medium distinct mottles of olive (5Y 4/3) and few fine distinct mottles of yellowish brown (10YR 5/4); common large wedge-shaped peds having long axes tilted 10 to 60 degrees from the horizontal and bordered by intersecting slickensides, peds break to moderate medium and coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; aggregates have shiny pressure faces; few fine iron-manganese concretions; few calcium carbonate concretions as much as 1 centimeter in diameter; mildly alkaline; diffuse wavy boundary.

AC2g—52 to 74 inches; gray (5Y 5/1) clay, gray (5Y 6/1) dry; common fine and medium distinct mottles of light olive brown (2.5Y 5/4) and few fine distinct mottles of yellowish brown (10YR 5/6); weak fine angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine iron-manganese concretions; few intersecting slickensides; few irregularly shaped pitted calcium carbonate concretions generally less than 3 centimeters in size; mildly alkaline.

In undisturbed areas, gilgai microknolls are 6 to 12 inches higher than microdepressions. The center of the microknolls is about 4 to 16 feet from the center of the microdepressions. When the soils are dry, cracks 1 to 2 inches wide form on the surface and extend into the ACg horizon. Intersecting slickensides begin at a depth of about 20 to 30 inches. The A horizon is black or very dark gray. It ranges from slightly acid through mildly alkaline. The ACg horizon is very dark gray, dark gray, or gray. Mottles in the ACg horizon are olive, yellowish brown, light olive brown, strong brown, yellow, or red. The ACg horizon is clay or silty clay. It ranges from neutral through moderately alkaline. In some places it is calcareous in the lower part.

**Midland series**

The Midland series consists of deep, acid, nearly level, loamy soils on prairies. These soils formed in clayey and silty sediments.

These soils are poorly drained. Surface runoff and internal drainage are very slow. Permeability is very slow, and the available water capacity is high.

These soils are used mainly for native pasture, improved pasture, and rice. Some are in urban uses.

Representative profile of Midland silty clay loam, in pasture, from the intersection of Texas Highways NASA 1 and 146 in Seabrook, 1.4 miles north along Texas Highway 146, 0.32 mile west on Red Bluff Road, and 150 feet south:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, grayish brown (10YR 5/2) dry; common fine distinct mottles of dark brown; weak medium subangular blocky structure; very hard, firm, sticky and plastic; common fine roots; few fine pores; few worm casts; strongly acid; clear smooth boundary.

B21tg—7 to 20 inches; gray (10YR 5/1) silty clay, gray (10YR 6/1) dry; weak fine and medium angular blocky structure; very hard, firm, sticky and plastic; few fine roots; few fine pores; few fine faint brownish stains along root channels and on ped faces; patchy clay films; few worm casts; few fine iron-manganese concretions; medium acid; gradual smooth boundary.

B22tg—20 to 37 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; common fine distinct mottles of reddish brown; moderate medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few very fine roots; patchy clay films; few coarse slickensides that do not intersect; few iron-manganese concretions; few crayfish krotovinas filled with gray (10YR 5/1) silty clay; slightly acid; gradual smooth boundary.

B23tg—37 to 50 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; few fine distinct mottles of dark brown; moderate medium angular blocky structure; extremely hard, very firm, very sticky and plastic; patchy clay films; few fine iron-manganese concretions; few crayfish krotovinas filled with gray (10YR 5/1) silty clay; neutral; diffuse smooth boundary.

B3g—50 to 72 inches; mottled gray (10YR 6/1), olive yellow (2.5Y 6/6), and brownish yellow (10YR 6/6) clay; brownish yellow increases with depth; massive; extremely hard, very firm, very sticky and plastic; few streaks of gray (10YR 5/1) material; few iron-manganese concretions; moderately alkaline.

The A horizon is 4 to 16 inches thick. It is dark gray, gray, dark grayish brown, or grayish brown. It is strongly acid through slightly acid. The B2tg horizon is dark gray, gray, or light olive gray. Mottles in the B2tg horizon are mainly reddish brown, dark brown, brownish yellow, or olive yellow. The B2tg horizon is clay, silty clay, or heavy clay loam that averages 35 to 55 percent clay. It is medium acid through moderately alkaline. In some places, calcium carbonate concretions are below a depth of 30 inches. The B3g horizon has the same colors as the B2tg horizon, but it is more coarsely mottled.

**Nahatche series**

The Nahatche series consists of nearly level, loamy, stratified soils on bottomlands. These soils are on flood plains along the major streams and their tributaries. They formed in loamy alluvial sediments.

These soils are subject to flooding one or more times each year for a few days to about a month. The water table is within 20 inches of the surface, mainly during the winter or early in spring. The soils are somewhat poorly drained. Surface runoff is slow, and permeability is moderate. The available water capacity is medium. These soils are used mainly for woodland grazing and wildlife habitat. A few areas are used for timber production and improved pasture.

Representative profile of Nahatche loam, in pasture, from the intersection of Interstate Highway 10 and Texas Highway 6 in Addicks, 2 miles north along Texas Highway 6, 0.73 mile east on Patterson Road, 400 feet north along Bear Creek, and 200 feet west:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; common fine distinct mottles of yellowish brown; weak fine subangular blocky structure; hard, friable; few fine roots; common worm casts; medium acid; clear smooth boundary.

C1g—5 to 18 inches; grayish brown (10YR 5/2) loam, light brownish gray (10YR 6/2) dry; common fine and medium distinct mottles of yellowish brown (10YR 5/8); weak fine and medium subangular blocky structure parting to fine granular; hard, friable; few fine roots; few fine pores; few thin strata of brown loamy fine sand and dark gray silt loam; medium acid; clear smooth boundary.

C2g—18 to 30 inches; gray (10YR 5/1) loam, gray (10YR 6/1) dry; few fine distinct mottles of yellowish brown; weak medium subangular blocky structure; hard, friable; few fine roots; common thin strata of pale brown (10YR 6/3) loamy fine sand; slightly acid; clear wavy boundary.

C3g—30 to 48 inches; *gray* (10YR 5/1) sandy clay loam, gray (10YR 6/1) dry; common fine and medium distinct mottles of brownish yellow (10YR 6/8), few fine distinct mottles of strong brown and few fine faint mottles of light gray; weak medium subangular blocky structure; very hard, firm; common thin strata of pale brown (10YR 6/3) loamy fine sand; few fine iron-manganese and calcium carbonate concretions; neutral; gradual wavy boundary.

C4g—48 to 60 inches; gray (10YR 5/1) clay loam; gray (10YR 6/1) dry; many medium faint mottles of light gray (10YR 6/1); common fine distinct mottles of brownish yellow; weak fine and medium subangular blocky structure; very hard, firm; common calcium carbonate concretions less than 3 centimeters in diameter; common fine iron-manganese concretions; moderately alkaline.

The A horizon is 4 to 10 inches thick. It is very dark grayish brown, dark grayish brown, grayish brown, or brown. Where values are 3.5 or lower, the horizon is less than 7 inches thick. In some places it has mottles of gray, dark gray, brown, yellowish brown, or dark yellowish brown. It is medium acid through very strongly acid. The Cg horizon is dark gray, gray, light gray, grayish brown, light brownish gray, brown, or pale brown. Mottles, where present, are brown, strong brown, yellowish brown, or brownish yellow. The Cg horizon is stratified with thin layers of loamy fine sand, sandy loam, loam, silt loam, sandy clay loam, clay loam, and silty clay loam. The layers between depths of 10 and 40 inches are 18 to 30 percent clay. The Cg horizon is medium acid through moderately alkaline. In a few places buried soils are below a depth of 40 inches.

**Ozan series**

The Ozan series consists of deep, acid, nearly level, loamy soils in low lying, forested areas and in depressions. These soils formed in loamy marine deposits.

These soils are poorly drained. Surface runoff is very slow to ponded. The soils are saturated for extended periods during winter and early in spring. Water stands on the surface of the depressions for long periods following heavy rains. Internal drainage and permeability are slow, and the available water capacity is high.

These soils are used mainly for woodland grazing and timber production. A few areas are in urban use.

Representative profile of Ozan loam, in timber, from the northeast corner of Harris County, 1,100 feet southeast to the intersection of Liberty County line and Huffman-Cleveland Road, 1.27 miles south along Huffman-Cleveland Road, and 75 feet east:

A1—0 to 2 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10Y R 5/2) dry; weak medium granular structure; hard, friable; many fine roots; 1/4 inch of leaf litter on surface; common worm casts; common fine streaks and pockets of very pale brown (10YR 7/3) uncoated fine sand; strongly acid; clear smooth boundary.

A21g—2 to 8 inches; light brownish gray (10YR 6/2) loam, light gray (10YR 7/2) dry; weak fine and medium granular structure; hard, friable; few find roots; many worm casts; few quartz pebbles less than 7 millimeters in diameter; common fine streaks and pockets of light yellowish brown (10YR 6/4) uncoated fine sand; few crayfish krotovinas filled with uncoated fine sand and silt; strongly acid; clear wavy boundary.

A22g—8 to 18 inches; light brownish gray (10YR 6/2) loam, light gray (10YR 7/2) dry; few fine and medium faint mottles of dark yellowish brown and yellowish brown; weak fine and medium subangular blocky structure; hard, friable; common fine and medium pores; many worm casts; few iron-manganese concretions as much as 5 millimeters in diameter; common crayfish krotovinas; lower part of horizon has common vertical streaks and small amounts of B21tg material; common streaks and pockets of pale brown fine sandy loam; strongly acid; gradual irregular boundary.

B21tg & A22g—18 to 51 inches; light brownish gray (10YR 6/2) loam, light gray (10YR 7/2) dry; common fine and medium distinct mottles of dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6); weak medium subangular blocky structure; hard, friable; common fine and medium pores; many worm casts; few iron-manganese concretions less than 5 millimeters in diameter; common tongues of loamy A2g material and pockets of pale brown (10YR 6/3) fine sandy loam; common crayfish krotovinas throughout; medium acid; gradual wavy boundary.

B22tg—51 to 65 inches; light brownish gray (10YR 6/2) sandy clay loam, light gray (10YR 7/2) dry; common fine and medium prominent red (2.5YR 4/6) mottles surrounded by medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very hard, friable; common fine and medium pores; common crayfish krotovinas; strongly acid.

The A horizon is 10 to 18 inches thick. The A 1 horizon is dark gray, dark grayish brown, gray, grayish brown, light brownish gray, or light gray. It is medium acid through very strongly acid. The A2g horizon is gray, light brownish gray, or light gray and has brownish or yellowish mottles in some places. The lower part of the A2g horizon has vertical streaks of uncoated sand and silt that tongue into the Btg horizon. The A2g horizon is loam, silt loam, or fine sandy loam. It is medium acid through very strongly acid. The B2tg horizon is gray, light gray, or light brownish gray and has strong brown, reddish yellow, or red mottles. It is loam, sandy clay loam, clay loam, or silty clay loam that is 18 to 30 percent clay. The B2tg horizon is medium acid through very strongly acid. In a few places the B2tg horizon is slightly acid through mildly alkaline below a depth of 60 inches.

**Segno series**

The Segno series consists of deep, acid, nearly level to gently sloping, loamy soils on forested uplands. These soils have a loamy upper layer over a more clayey layer that contains plinthite (fig. 16). They formed in thick beds of unconsolidated loamy sediments.

These soils are moderately well drained. Surface runoff is slow to medium. Internal drainage in the layers having plinthite is moderately slow. Permeability is moderately slow, and the available water capacity is medium.

These soils are used mainly for woodland grazing, timber production, and improved pasture.

Representative profile of Segno fine sandy loam, 0 to 1 percent slopes, in timber, from intersection of Huffsmith-Kohrville Road and Huffsmith Road in Huffsmith, 3.25 miles southeast along Huffsmith Road, 1.4 miles north on Kuykendahl Road, and 75 feet west:

A1—0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; slightly hard, friable; few fine roots; few fine ironstone pebbles; strongly acid; clear smooth boundary.

A2—5 to 13 inches; pale brown (10YR 6/3) fine sandy loam, very pale brown (10YR 7/3) dry; massive; slightly hard, friable; few fine and medium roots; few ironstone pebbles less than 1 centimeter in diameter in upper part increasing to 15 percent ironstone pebbles in lower part; very strongly acid; abrupt smooth boundary.

B21t—13 to 25 inches; yellowish brown (10YR 5/6) sandy clay loam, brownish yellow (10YR 6/6) dry; few fine faint reddish brown mottles surrounding ironstone pebbles; moderate medium subangular blocky structure; hard, friable; few sand grains on ped faces; very strongly acid; clear smooth boundary.

B22t—25 to 42 inches; brownish yellow (10YR 6/6) sandy clay loam, yellow (10YR 7/6) dry; many medium and coarse distinct yellowish red (5YR 4/6) mottles mainly surrounding red (2.5YR 4/8) plinthite (15 percent); moderate medium subangular blocky structure; hard, friable; very strongly acid; gradual wavy boundary.

B23t—42 to 60 inches; distinctly mottled brownish yellow (10YR 6/6), red (2.5YR 4/6), and gray (10YR 6/1) sandy clay loam; weak medium and coarse subangular blocky structure; hard, friable; 15 percent plinthite; very strongly acid; gradual wavy boundary.

B24t—60 to 75 inches; light gray (10YR 7/1) sandy clay loam, white (10YR 8/1) dry; common medium distinct yellowish brown (10YR 5/8) and red (10YR 6/6) mottles; weak medium and coarse subangular blocky structure; hard, friable; red mottles are commonly plinthite; very strongly acid.

The A horizon is 6 to 18 inches thick. It is slightly acid through very strongly acid. The A 1 horizon is dark gray, gray, dark grayish brown, grayish brown, or brown. In a few areas where it is less than 7 inches thick, it is very dark grayish brown or dark brown. The A2 horizon is dark grayish brown, grayish brown, brown, pale brown, very pale brown, yellowish brown, or light brownish gray. The B2t horizon is sandy clay loam or clay loam. It is medium acid through very strongly acid. The B21t and B22t horizons are yellowish brown, reddish yellow, brownish yellow, or strong brown. In most places these horizons have mottles of reddish brown, red, or yellow. The B23t and B24t horizons are distinctly or prominently mottled with red, gray, and yellowish brown.

**Vamont series**

The Vamont series consists of deep, acid, nearly level to gently sloping, clayey soils on forested uplands. These soils formed in thick beds of alkaline marine clay.

Undisturbed areas have gilgai microrelief. When the soils are dry, deep wide cracks form on the surface. Water enters the soil rapidly through the cracks; it enters very slowly when the soil is wet and the cracks are sealed. These soils are somewhat poorly drained. Surface runoff is slow to rapid. Internal drainage is slow to very slow. Permeability is very slow, and the available water capacity is high.

These soils are used mainly for woodland grazing and timber production. Some are used for urban development.

Representative profile of Vamont clay, 0 to 1 percent slopes, in the center of a microdepression, in timber, from the intersection of Crosby Road and Farm Road 2100 in Crosby, 1.35 miles north along Farm Road 2100 to its intersection with pipeline, 1,800 feet west along the pipeline, and 50 feet north:

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) clay, dark grayish brown (10YR 4/2) dry; few fine faint mottles of gray; weak fine angular and granular structure; hard, firm, very sticky and plastic; common fine roots and worm casts; medium acid; clear wavy boundary.

AC1—8 to 24 inches, prominently and coarsely mottled yellowish brown (10YR 5/4, 5/6, and 5/8) and gray (10YR 5/1) clay, brownish yellow (10YR 6/6, 6/8) and gray (10YR 6/1) dry; few fine distinct strong brown mottles; moderate fine subangular blocky structure; some black charcoal masses; very hard, firm, very sticky and plastic; few fine and coarse woody roots; few intersecting slickensides at a depth of 15 inches; few black concretions 3 millimeters in diameter; few worm casts; strongly acid; clear wavy boundary.

AC2—24 to 48 inches; grayish brown (10YR 5/2) clay, light brownish gray (10YR 6/2) dry; few fine distinct yellowish brown and brownish yellow mottles; moderate fine and medium angular blocky structure; very hard, very firm, very sticky and plastic; few fine and medium woody roots; common intersecting slickensides; few black concretions 3 millimeters in diameter; strongly acid; clear wavy boundary.

AC3—48 to 70 inches; grayish brown (10YR 5/2) clay, light brownish gray (10YR 6/2) dry; common fine distinct yellowish brown mottles and few fine faint grayish brown mottles; common intersecting slickensides parting to moderate medium blocky structure; very hard, very firm, very sticky and plastic; few fine roots and pores; shiny pressure faces; medium acid; clear wavy boundary.

C—70 to 94 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; few fine distinct brownish yellow mottles and few fine prominent yellowish red mottles; coarse intersecting slickensides parting to weak medium angular blocky structure; very hard, very firm, very sticky and plastic; few fine roots; slightly acid.

Undisturbed areas have gilgai microrelief. The knolls are 6 to 15 inches higher than the depressions. Intersecting slickensides and wedge-shaped parallelepipeds begin at a depth of 8 to 25 inches. The A horizon is 2 to 9 inches thick. It is very dark gray, very dark grayish brown, dark grayish brown, or brown. It is very strongly acid through neutral. The AC horizon is yellowish brown, brownish yellow, light olive brown, grayish brown, or yellowish red. It has mottles of gray or strong brown. It is strongly acid through neutral. The C horizon is light gray, gray, or grayish brown. It has mottles of brownish yellow, yellowish red, yellowish brown, olive brown, or strong brown. It is medium acid through mildly alkaline and is calcareous in some places. A few calcium carbonate concretions up to 2 inches in diameter are in the C horizon in some places.

**Voss series**

The Voss series consists of nearly level to gently sloping sandy soils. These soils occupy low terraces, flood plains, and sandbars along the major streams and their tributaries. They formed in deep sandy alluvial sediments and have no stratification of fine material (fig. 17).

These soils flood one or more times each year. They are saturated for a few days, mainly during the cool months. A water table is static at a depth of 2 to 5 feet for 6 to 10 months and is seldom at a depth of more than 7 feet. These soils are moderately well drained to somewhat poorly drained. Surface runoff is slow, and permeability is rapid. Internal drainage is impeded by the shallow seasonal water table. The available water capacity is very low.

These soils are used mostly for woodland grazing and timber production.

Representative profile of Voss sand, in timber, from the intersection of U.S. Highway 90 and Magnolia Gardens Road in Sheldon, 3.53 miles northeast along Magnolia Gardens Road and 100 feet west:

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) sand, dark grayish brown (10YR 4/2) dry; single grained; loose; common fine roots; common fine particles of decomposing organic matter; medium acid; abrupt smooth boundary.

C1—5 to 30 inches; light gray (10YR 7/2) uncoated sand, light gray dry; single grained; loose; few fine roots; few quartz pebbles as much as 10 millimeters in diameter; slightly acid; gradual smooth boundary.

C2—30 to 70 inches; light gray (10YR 7/2) sand, light gray dry; single grained; finer grained than C1 horizon; loose; few quartz pebbles as much as 10 millimeters in diameter; saturated; neutral.

Reaction is medium acid through neutral. Texture is sand or fine sand. Quartz pebbles less than 1/2 inch in diameter make up less than 2 percent of the soil. The Al horizon is very dark gray, very dark grayish brown, dark gray, dark grayish brown, or grayish brown. The C horizon is light brownish gray, light gray, white, pale brown, or very pale brown.

**Wockley series**

The Wockley series consists of deep, acid, nearly level, loamy soils on prairies. Pine and hardwoods have encroached in some areas. These soils have loamy upper layers and more clayey lower layers that have gray mottles and that are more than 5 percent plinthite (fig. 18). These soils formed in thick, loamy, unconsolidated sediments of marine origin.

These soils are somewhat poorly drained. Surface runoff is slow. Permeability is moderately slow, and the available water capacity is medium.

These soils are used mainly for rice and improved pasture. Some are in urban use.

Representative profile of Wockley fine sandy loam, in pasture, from the intersection of Hegar Road and U.S. Highway 290 in Hockley, 4 miles southeast along U.S. Highway 290, 1 mile north on Bauer Road, and 30 feet west:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; few mottles of fine faint strong brown; weak fine granular structure; slightly hard, friable; common fine roots; common fine pores; strongly acid; clear wavy boundary.

A2—7 to 22 inches; brown (10YR 5/3) fine sandy loam, pale brown (10YR 6/3) dry; few fine faint mottles of strong brown; weak fine subangular blocky structure parting to weak fine granular; slightly hard, friable; few fine roots; common fine pores; few iron oxide concretions generally less than 5 millimeters in diameter; medium acid; gradual wavy boundary.

B21t—22 to 33 inches; brown (10YR 5/3) sandy clay loam, very pale brown (10YR 7/3) dry; common fine and medium distinct mottles of yellowish brown (10YR 5/6) and red (2.5YR 4/8) and common fine and medium mottles of faint light brownish gray

(10YR 6/2); weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, firm; few patchy clay films; common iron oxide concretions generally less than 1 centimeter in diameter; centers of red mottles are plinthite and make up 2 to 5 percent of the volume; strongly acid; gradual wavy boundary.

B22t—33 to 60 inches; light brownish gray (10YR (6/2) sandy clay loam, light gray (10YR 7/2) dry; many medium and coarse distinct mottles of yellowish brown (10YR 5/6) and red (2.5YR 4/5); weak coarse prismatic structure parting to moderate medium subangular blocky structure; very hard, firm; patchy clay films on surfaces of peds; common iron oxide concretions generally less than 1 centimeter in diameter; centers of red mottles are plinthite and make up 12 percent of the volume; medium acid.

The A horizon is 13 to 30 inches thick. It is slightly acid through strongly acid. The Ap horizon is very dark grayish brown, dark grayish brown, grayish brown, dark brown, brown, or pale brown. Where values are 3.5 or lower, the horizon is less than 7 inches thick. The A2 horizon is dark grayish brown, grayish brown, brown, pale brown, or yellowish brown. The B21t horizon is brown, pale brown, or yellowish brown. It has common mottles of gray, grayish brown, light brownish gray, red, yellowish red, brown, or strong brown. The B21t horizon is loam, sandy clay loam, or clay loam and is medium acid to very strongly acid. The B22t horizon is gray, grayish brown, light brownish gray, or light gray. Mottles are yellowish brown, brownish yellow, strong brown, red, or dark red. The B22t horizon is sandy clay loam or clay loam. It is slightly acid to strongly acid. Plinthite makes up 5 to 15 percent by volume of this horizon.

## Classification

The system of soil classification currently used was adopted *by the* National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to the “Unedited Text of the National Cooperative Soil Survey,” which is available at the SCS State Office, Temple, Texas.

The system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the basis for classification is the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 20 the soils of the survey area are classified according to the system. Classes of the system are briefly discussed in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol.* An example is Mollisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and that are important to plant growth or that were selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll—*Aqu*, meaning water, plus *oll,* from Mollisol.

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. The name of a great group ends with the name of a suborder. A prefix added to the name suggests something about the properties of the soil. An example is Haplaquolls—*Hapl*, meaning simple horizons, plus *aquoll,* the suborder of Mollisols that have an aquic moisture regime.

SUBGROUP. Each great group is divided into three subgroups: The central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extra grades that have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. The names of subgroups are derived by placing one or more adjectives before the name of the great group. The adjective *Typic* is used for the subgroup that is thought to typify the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the root zone, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine, montmorillonitic, thermic, Typic Haplaquolls.

SERIES, The series consists of a group of sails that formed in a particular kind of parent material and have horizons that, except far the texture of the surface layer, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, anti mineral and chemical composition. An example is the Harris series.

# Formation of the Soils

This section discusses the factors of soil formation, relates them to the formation of soils in the survey area, anti explains the processes of soil formation.

## Factors of Soil Formation

The characteristics of the soil at any given point are determined by the physical anti mineral composition of the parent material; the climate under which the parent material accumulated and has existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material. All five of these factors influence the present characteristics of every soil, but the significance of each factor varies from one place to another. In one area one factor may dominate the formation of a soil, and in another area a different factor may be more important.

The interrelationship among these five factors is complex, and the effects of any one factor cannot be isolated and completely evaluated. It is convenient to discuss each factor Separately, however, and to indicate the probable effects of each.

### Parent Material

Parent material is the unconsolidated mass from which a soil forms. It determines the chemical and mineral composition of the soil. In Harris County the parent material consists of unconsolidated sediment of Holocene, Pleistocene, and Pliocene age. In general, the soils are sedimentary and consist of material that has been deposited by water. In some areas, terrace or beach deposits of noncalcareous unconsolidated material range from sand to clay. Some of the soils on the prairie developed from calcareous clayey sediment.

The Voss soils formed in thick beds of sand. These soils consist of highly resistant quartz sand and lack clay-enriched horizons, Hockley anti Segno soils developed in loamy deposits. These soils have clay-enriched horizons that contain concentrations of iron oxide; water movement in these soils is moderate. Lake Charles soils developed in calcareous clayey deposits. The clayey material has retarded the movement of water and air, and the resulting soils lack clay-enriched horizons and have free carbonates in the lower layers.

### Climate

The climate of Harris County is humid—warm and moist—and is presumed to be similar to the climate existing when the soils were formed. The dominant influence of climate in soil development in the county has been the amount and distribution of precipitation. The moderate amount of rainfall has promoted moderately rapid soil development. Climate is uniform throughout the county, although its effect is modified locally by runoff. In Harris County, the differences between soils are not attributed to climate.

### Plant and Animal Life

In Harris County, plants, insects, microorganisms, earthworms, crayfish, and other forms of living organisms have contributed to the development of the soils. Gains in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity are some of the changes caused by plant and animal life.

Vegetation, dominantly tall and midgrasses, has affected soil formation in Harris County more than other living organisms. The climax vegetation contributed significantly toward the accumulation of organic matter and the darkening of the surface layer in such soils as Addicks, Bernard, and Lake Charles. In some areas because of timber vegetation, the soils, such as the Boy and Kenney soils, are generally low in organic matter.

### Relief

Relief or topography affects soil formation through its effect on drainage, erosion, plant cover, and soil temperature.

In Harris County the degree of profile development depends mainly on the amount of moisture in the soil. The soils that receive excess water, such as the Gessner and Ozan soils in depressions, have developed gleyed characteristics. Because the soils are poorly drained and have wet characteristics, degraded horizonation is evident. Soils on more sloping areas, such as the Hockley and Segno soils, exhibit characteristics of better drained soils, which have distinct horizonation throughout. Nearly level soils on the uplands, such as the Bernard soils and Katy soils, have a well developed profile. These nearly level areas are very resistant to geological erosion, so soil development proceeds normally.

Plant cover is thinner in many of the more sloping areas. This increases the risk of erosion and retards soil formation.

### Time

The length of time that the soil-forming factors have acted on the parent material determines, to a large degree, the characteristics of the soil. This applies mainly to soils that are in favorable positions fur soil development. In Harris County, Nahatche and Ratliff soils show little soil development. Soils that have been acted upon for a long time by soil-forming processes show greater development and are deeper. Examples are Hockley soils and Segno soils.

## Processes of Soil Horizon Differentiation

Several processes were involved in the formation of horizons in the soils of Harris County: accumulation of organic matter, leaching of calcium carbonates and bases, reduction and transfer of iron, and formation and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in the development of horizons.

Accumulation of organic matter in the upper part of a profile helps form an Al horizon. The soils of Harris County range from low to medium in organic matter. The Addicks soils have a medium amount of organic matter in the A1 horizon.

Leaching of calcium carbonates and bases has occurred in Bernard soils and Lake Charles soils. Some leaching has occurred in Addicks soils; these soils do not. have free lime in the upper 16 to 29 inches.

Reduction and transfer of iron, a process called gleying, is evident in the poorly drained soils of the county. The gray color in the subsoil indicates reduction and loss of iron. Some horizons have pale yellow to brown mottles and concretions, indicating a segregation of iron. The Ozan soils, far example, are poorly drained, are gray, and are mottled in the lower horizons.

In Katy soils, there has been some translocation of clay minerals, which has contributed to horizon development. The B2t horizons have an accumulation of clay (clay films) in pores and on ped surfaces. Katy soils were probably leached of carbonates and soluble salts before the translocation of silicate clay took place.

## Literature Cited

(1) Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. In 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Barton. D.C. 1930. Surface geology of coastal southeast Texas. Bull. Amer. Assoc. Pet. Geol., vol. 14, pp. 1301-1320

(4) Bernard, H. A. and R.J. LeBlanc. 1965. Resume of the Quaternary geology of the northwestern Gulf of Mexico Province. Quaternary of the U.S. Princeton Univ. Press. pp. 137-185

(5) Derton, N. H., L. W. Stephenson, and J. A. Gardner. 1937. Geologic map of Texas. U.S. Geol. Surv.

(6) Fisher, W. L. and others. 1972. Environmental geologic atlas of the Texas Gulf Coast: Galveston-Houston area. Univ. Tex. Bur. Econ. Geol., 91 pp., illus.

(7) Hunt, C.B. 1967. Physiography of the United States, W. H. Freeman and Co., 480 pp.

(8) Sellards, E. H., W. S. Adkins, and F. B. Plummer. 1932. Geology of Texas, stratigraphy, vol. 1. Univ. Texas Bull. 3232, 1007 pp., illus.

(9) Texas University Bureau of Economic Geology. 1968. Geologic atlas of Texas, Houston sheet.

(10) Texas university Bureau of Economic Geology. 1968. Geologic Atlas of Texas, Beaumont sheet.

(11) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

(12) United States Department of Agriculture, Agricultural Research Service. 1965. Predicting rainfall-erosion losses from cropland east of the Rocky Mountains. U.S. Dep. Agric. Handb. 282, 47 pp.

(13) United States Department of Agriculture, Soil Conservation Service. 1970. Controlling erosion on construction sites.. U.S. Dep. Agric. Inf. Bull. 347, 32 pp., illus.

(14) United States Department of Agriculture, Soil Conservation Service. 1971. Soils and septic tanks. U.S. Dep. Agric. Inf. Bull. 349, 12 pp., illus. illus.

(15) Van Siclen, D. C. and R. W. Harlan. 1965. The deltaic Coastal Plain field handbook. Houston Geol. Soc., 71 pp.

## Glossary

**Aggregate, soil.** Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called beds. Clods are aggregates produced by tillage or logging.

**Alkali (sodic) soil**. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

**Alluvium.** Material, such as sand, silt, or clay, deposited on land by streams.

**Area reclaim**. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

**Association**, **soil**. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping unit.

**Available water capacity (available moisture capacity).** The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as —

| | *Inches* |
|---|---|
| Very low | 0 to 3 |
| Low | 3 to 6 |
| Medium | 6 to 9 |
| High | More than 9 |

**Calcareous soil**. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

**Clay**. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

**Clay film**. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or rout channels. Synonyms: clay coat, clay skin,

**Claypan**. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

**Complex slope**. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

**Complex**, **soil**. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

**Compressible**. Excessive decrease in volume of soft soil under load.

**Concretions**. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

**Consistence**, **soil**. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

*Loose*.—Noncoherent when dry or moist; does not hold together in a mass.

*Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

*Firm*.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

*Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will forma “wire” when rolled between thumb and forefinger.

*Sticky.*—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

*Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

*Soft.*—When dry, breaks into powder or individual grains under very slight pressure.

*Cemented.*—Hard; little affected by moistening.

**Corrosive**. High risk of corrosion to uncoated steel or deterioration of concrete.

**Cutbanks cave**. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

**Drainage class** (**natural**). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

*Excessively drained*.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

*Somewhat excessively drained.*—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

*Well drained.*—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

*Moderately well drained.*—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

*Somewhat poorly drained.*—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic craps unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

*Poorly drained.*—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

*Very poorly drained.*—Water is removed from the soil so slowly that free water remains at or on the surface during must of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in “hillpeats” and “climatic moors.”

**Erosion**. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

*Erosion* (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

*Erosion* (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

**Excess alkali**. Excess exchangeable sodium. The resulting poor physical properties restrict the growth of plants.

**Excess fines**. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

**Excess salts**. Excess water soluble salts. Excessive salts restrict the growth of most plants.

**Fast intake**. The rapid movement of water into the soil.

**Favorable**. Favorable soil features for the specified use.

**Genesis**, **soil**. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

**Gilgai**. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope.

**Gleyed soil**. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term “gleyed” also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

**Hardpan**. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

**Horizon**, **soil**. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

*O horizon.*—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

*A horizon.*—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

*A2 horizon.*—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

*B horizon*.—The mineral horizon below an *A horizon*. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

*C horizon.—The* mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

*R layer*.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

**Humus**. The well decomposed, more or less stable part of the organic matter in mineral soils.

**Hydrologic soil groups** give the runoff potential from rainfall. Four major soil groups are used. The soils are classified on the basis of intake of water at the end of long duration storms occurring after prior wetting and opportunity for swelling, and without the protective effects of vegetation.

The major soil groups are:

A. (Low runoff potential). Soils having high infiltration rates even when thoroughly wetted. These consist chiefly of deep, well to excessively drained sands or gravels. These soils have a high rate of water transmission in that water readily passes through them.

B. Soils having moderate infiltration rates when thoroughly wetted. These consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

C. Soils have slow infiltration rates when thoroughly wetted. These consist chiefly of soils with a layer that impedes downward movement of water or soils with moderately fine to fine texture. These soils have a slow rate of water transmission.

D. (High runoff potential). Soils having very slow infiltration rates when thoroughly wetted. These consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.

**Irrigation**. Application of water to soils to assist in production of crops. Methods of irrigation are—

*Border.*—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

*Basin.*—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

*Controlled, flooding.*—Water is released at intervals from closely spaced field Glitches and distributed uniformly over the field.

*Corrugation*.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

*Furrow.*—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

*Sprinkler.*—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

*Subirrigation.*—Water is applied in open ditches or file lines until the water table is raised enough to wet the soil.

*Wild flooding.*—Water*,* released at high points, is allowed to flow onto an area without controlled distribution.

**Krotovina**. An animal burrow in one soil horizon that has been filled with organic matter or material from another horizon. (Also spelled “crotovina”.)

**Liquid limit**. The moisture content at which the soil passes from a plastic to a liquid state.

**Loam**. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

**Low strength.** Inadequate strength for supporting loads.

**Microrelief**. Minor elevations and depressions on the surface.

**Morphology**, **soil**. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

**Mottling**, **soil**. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* and *many;* size—*fine, medium,* and *coarse;* and con*trast—faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

**Munsell notation**. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

**Noncalcareous**. A soil that may or may not be alkaline but that does not contain enough free Lime to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

**Parallelepipeds**. A six-sided prism whose faces are parallelograms.

**Ped**. An individual natural soil aggregate, such as a granule, a prism, or a block.

**Peres slowly**. The slow movement of water through the soil adversely affecting the specified use.

**Permeability**. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), slow (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

**Phase**, **soil**. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

**Piping**. Moving water of subsurface tunnels or pipelike cavities in the soil.

**Pitting**. Formation of pits as a result of the melting of ground ice after the removal of plant cover.

**Plasticity index**. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

**Plastic limit**. The moisture content at which a soil changes from a semisolid to a plastic state.

**Plinthite**. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents that commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on exposure to repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade, whereas ironstone cannot be cut but can be broken or shattered with a spade. Plinthite is one form of the material that has been called laterite.

**Plowpan**. A compacted layer formed in the soil directly below the plowed layer.

**Poorly** graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

**Poor outlets**. Surface or subsurface drainage outlets difficult or expensive to install.

**Profile**, **soil**. A vertical section of the soil extending through all its horizons and into the parent material.

**Reaction**, **soil**. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

| | *pH* |
|---|---|
| Extremely acid | Below 4.5 |
| Very strongly acid | 4.5 to 5.0 |
| Strongly acid | 5.1 to 5.5 |
| Medium acid | 5.6 to 6.0 |
| Slightly acid | 6.1 to 6.5 |
| Neutral | 6.6 to 7.3 |
| Mildly alkaline | 7.4 to 7.8 |
| Moderately alkaline | 7.9 to 8.4 |
| Strongly alkaline | 8.5 to 9.0 |
| Very strongly alkaline | 9.1 and higher |

**Residuum (residual soil material).** Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

**Rooting depth**. The soil is shallow over a layer that greatly restricts roots.

**Runoff**. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

**Saline soil**. A sail containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

**Sand**. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

**Seepage**. The rapid movement of water through the soil. Seepage adversely affects the specified use.

**Series, soil.** A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

**Shrink-swell**. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

**Silt**. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

**Site index**. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

**Slickensides**. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

**Slow intake**. The slow movement of water into the soil.

**Slow refill**. The slow filling of ponds, resulting from restricted permeability in the soil.

**Soil**. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

**Soil separates**. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to *0.05* millimeter); *silt* (0.005 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

**Stratified**. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

**Structure**, **soil**. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

**Subsoil**. Technically, the B horizon; roughly, the part of the solum below plow depth.

**Surface soil**. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer,” or the “Ap horizon.”

**Terrace**. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

**Terrace** (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

**Texture**, **soil**. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand,* *loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

**Thin layer**. Otherwise suitable soil material too thin for the specified use.

**Tilth**, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

**Topsoil**. (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

**Upland (geology).** Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

**Unstable fill**. Risk of caving or sloughing in banks of fill material.

**Water table**. The upper limit of the soil or underlying rock material that is wholly saturated with water.

*Water table, apparent.* A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

*Water table, artesian. A* water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

*Water table, perched. A* water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

**Well graded**. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

**Wilting point (or permanent wilting point).** The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

# APPENDIX
# TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[Data from Houston, elevation 96 feet. Period of record 1931-70]

| Month | Temperature | | | | Precipitation | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Probability of receiving-- | | | | | | | | Mean number of days with-- | | |
| | Mean daily maximum | Mean monthly maximum | Mean daily minimum | Mean monthly minimum | Mean total | 0 or trace | .5 inch or more | 1 inch or more | 2 inches or more | 3 inches or more | 4 inches or more | 5 inches or more | 6 inches or more | .1 inch or more | .5 inch or more | 1 inch or more |
| | F | F | F | F | In | Pct | Pct | Pct | Pct | Pct | Pct | Pct | Pct | | | |
| January--- | 63.6 | 78.6 | 43.6 | 25.0 | 3.78 | <1 | 97 | 92 | 74 | 54 | 35 | 24 | 14 | 5 | 2 | 1 |
| February-- | 65.5 | 79.8 | 46.0 | 30.1 | 3.44 | <1 | 96 | 90 | 70 | 49 | 30 | 19 | 14 | 5 | 2 | 1 |
| March----- | 71.7 | 84.4 | 50.8 | 34.1 | 2.67 | <1 | 93 | 80 | 58 | 38 | 25 | 18 | 10 | 4 | 1 | 1 |
| April----- | 78.0 | 88.0 | 59.0 | 45.5 | 3.24 | <1 | 96 | 90 | 70 | 50 | 35 | 20 | 14 | 4 | 2 | 1 |
| May------- | 85.7 | 91.9 | 66.2 | 55.6 | 4.32 | <1 | 93 | 85 | 73 | 55 | 43 | 33 | 22 | 5 | 3 | 2 |
| June------ | 91.1 | 96.2 | 72.0 | 65.0 | 3.69 | <1 | 93 | 82 | 63 | 45 | 34 | 25 | 16 | 5 | 3 | 2 |
| July------ | 92.1 | 98.0 | 73.8 | 70.2 | 4.29 | <1 | 96 | 90 | 75 | 55 | 40 | 30 | 25 | 5 | 2 | 1 |
| August---- | 92.8 | 98.7 | 73.6 | 68.7 | 4.27 | <1 | 95 | 85 | 70 | 50 | 40 | 30 | 20 | 6 | 3 | 2 |
| September- | 89.1 | 95.7 | 69.3 | 59.2 | 4.26 | <1 | 95 | 86 | 70 | 55 | 40 | 30 | 25 | 6 | 3 | 1 |
| October--- | 82.3 | 91.3 | 60.4 | 46.1 | 3.77 | 3 | 85 | 85 | 55 | 40 | 30 | 20 | 11 | 5 | 2 | 1 |
| November-- | 71.1 | 84.9 | 50.5 | 34.1 | 3.86 | <1 | 94 | 83 | 65 | 50 | 33 | 23 | 20 | 5 | 2 | 1 |
| December-- | 64.5 | 79.8 | 45.9 | 28.7 | 4.36 | <1 | 99 | 95 | 80 | 60 | 50 | 33 | 24 | 6 | 3 | 1 |
| Year---- | 79.0 | 88.9 | 59.3 | 46.9 | 45.95 | -- | -- | -- | -- | -- | -- | -- | -- | 61 | 28 | 15 |

TABLE 2.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

| Map symbol | Soil name | Acres | Percent |
|---|---|---|---|
| Ad | Addicks loam | 51,600 | 4.6 |
| Ak | Addicks-Urban land complex | 23,400 | 2.1 |
| Am | Aldine very fine sandy loam | 21,600 | 1.9 |
| An | Aldine-Urban land complex | 14,900 | 1.3 |
| Ap | Aris fine sandy loam | 14,800 | 1.3 |
| Ar | Aris-Gessner complex | 25,900 | 2.3 |
| As | Aris-Urban land complex | 14,500 | 1.3 |
| AtB | Atasco fine sandy loam, 1 to 4 percent slopes | 10,400 | 0.9 |
| Ba | Beaumont clay | 31,500 | 2.8 |
| Bc | Beaumont-Urban land complex | 17,200 | 1.5 |
| Bd | Bernard clay loam | 47,200 | 4.2 |
| Be | Bernard-Edna complex | 24,400 | 2.2 |
| Bg | Bernard-Urban land complex | 54,200 | 4.8 |
| Bn | Bissonnet very fine sandy loam | 5,700 | 0.5 |
| Bo | Boy loamy fine sand | 5,700 | 0.5 |
| Cd | Clodine loam | 50,400 | 4.5 |
| Ce | Clodine-Urban land complex | 35,800 | 3.2 |
| Ed | Edna fine sandy loam | 4,400 | 0.4 |
| Ge | Gessner loam | 83,400 | 7.4 |
| Gs | Gessner complex | 16,900 | 1.5 |
| Gu | Gessner-Urban land complex | 20,900 | 1.8 |
| Ha | Harris clay | 1,700 | 0.1 |
| Hf | Hatliff loam | 3,800 | 0.3 |
| HoA | Hockley fine sandy loam, 0 to 1 percent slopes | 6,400 | 0.6 |
| HoB | Hockley fine sandy loam, 1 to 4 percent slopes | 9,400 | 0.8 |
| Is | Ijam soils | 7,400 | 0.6 |
| Ke | Kaman clay | 3,100 | 0.3 |
| Kf | Katy fine sandy loam | 65,500 | 5.8 |
| Kn | Kenney loamy fine sand | 8,400 | 0.7 |
| Ku | Kenney-Urban land complex | 1,200 | 0.1 |
| LcA | Lake Charles clay, 0 to 1 percent slopes | 87,200 | 7.7 |
| LcB | Lake Charles clay, 1 to 3 percent slopes | 1,900 | 0.2 |
| Lu | Lake Charles-Urban land complex | 55,200 | 4.9 |
| Md | Midland silty clay loam | 88,100 | 7.8 |
| Mu | Midland-Urban land complex | 8,200 | 0.7 |
| Na | Nahatche loam | 6,300 | 0.6 |
| Oa | Ozan loam | 20,200 | 1.8 |
| On | Ozan-Urban land complex | 500 | ([1]) |
| SeA | Segno fine sandy loam, 0 to 1 percent slopes | 9,800 | 0.9 |
| SeB | Segno fine sandy loam, 1 to 3 percent slopes | 7,000 | 0.6 |
| Ur | Urban land | 1,400 | 0.1 |
| VaA | Vamont clay, 0 to 1 percent slopes | 3,400 | 0.3 |
| VaB | Vamont clay, 1 to 4 percent slopes | 21,200 | 1.9 |
| Vn | Vamont-Urban land complex | 4,500 | 0.4 |
| Vo | Voss sand | 4,300 | 0.4 |
| Vs | Voss soils | 700 | 0.1 |
| Wo | Wockley fine sandy loam | 97,800 | 8.7 |
| Wy | Wockley-Urban land complex | 2,800 | 0.2 |
| | Water | 27,400 | 2.4 |
| | Total | 1,129,600 | 100.0 |

[1]Less than 0.1 percent.

TABLE 3.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management in 1974. Absence of a yield figure indicates the crop is seldom grown or is not suited to the soil]

| Soil name and map symbol | Corn | Cotton lint | Grain sorghum | Rice | Soybeans | Common bermudagrass | Improved bermudagrass |
|---|---|---|---|---|---|---|---|
| | Bu | Lb | Bu | Bu | Bu | AUM[1] | AUM[1] |
| Addicks: | | | | | | | |
| Ad | 70 | 450 | 70 | 110 | 25 | 6.0 | 8.0 |
| [2]Ak | --- | --- | --- | --- | --- | --- | --- |
| Aldine: | | | | | | | |
| Am | 60 | --- | 55 | 100 | 25 | 6.5 | 10.0 |
| [2]An | --- | --- | --- | --- | --- | --- | --- |
| Aris: | | | | | | | |
| Ap | 70 | 500 | 60 | 130 | 30 | 6.5 | 10.0 |
| [2]Ar | 64 | 413 | 58 | 120 | 30 | 6.0 | 9.3 |
| [2]As | --- | --- | --- | --- | --- | --- | --- |
| Atasco: | | | | | | | |
| AtB | 60 | --- | 55 | --- | --- | 6.0 | 10.0 |
| Beaumont: | | | | | | | |
| Ba | 70 | 400 | 75 | 120 | 30 | 6.0 | 10.0 |
| [2]Bc | --- | --- | --- | --- | --- | --- | --- |
| Bernard: | | | | | | | |
| Bd | 80 | 500 | 90 | 120 | 30 | 6.0 | 10.0 |
| [2]Be | 66 | 465 | 82 | 120 | 25 | 5.5 | 9.4 |
| [2]Bg | --- | --- | --- | --- | --- | --- | --- |
| Bissonnet: | | | | | | | |
| Bn | 60 | --- | 55 | 100 | 25 | 6.5 | 10.0 |
| Boy: | | | | | | | |
| Bo | 45 | 300 | --- | --- | --- | 5.5 | 7.5 |
| Clodine: | | | | | | | |
| Cd | 65 | 400 | 60 | 110 | 25 | 5.5 | 8.0 |
| [2]Ce | --- | --- | --- | --- | --- | --- | --- |
| Edna: | | | | | | | |
| Ed | 40 | 400 | 65 | 120 | 25 | 5.5 | 8.0 |

See footnotes at end of table.

TABLE 3.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

| Soil name and map symbol | Corn | Cotton lint | Grain sorghum | Rice | Soybeans | Common bermudagrass | Improved bermudagrass |
|---|---|---|---|---|---|---|---|
| | Bu | Lb | Bu | Bu | Bu | AUM[1] | AUM[1] |
| Gessner: | | | | | | | |
| Gc, [2]Gs | 50 | 250 | 55 | 100 | 20 | 5.5 | 8.0 |
| [2]Gu | --- | --- | --- | --- | --- | --- | --- |
| Harris: | | | | | | | |
| Hn | --- | --- | --- | --- | --- | --- | --- |
| Hatliff: | | | | | | | |
| Hf | --- | --- | --- | --- | --- | 5.5 | 7.0 |
| Hockley: | | | | | | | |
| HoA | 80 | 450 | 70 | 100 | 25 | 8.0 | 10.0 |
| HoB | 75 | 400 | 65 | --- | 20 | 8.0 | 10.0 |
| Ijam: | | | | | | | |
| [2]Is | --- | --- | --- | --- | --- | --- | --- |
| Kaman: | | | | | | | |
| Ka | --- | --- | --- | --- | --- | 5.0 | 7.0 |
| Katy: | | | | | | | |
| Kf | 65 | 450 | 70 | 120 | 30 | 6.5 | 10.0 |
| Kenney: | | | | | | | |
| Kn | 30 | 250 | --- | --- | --- | 5.0 | 8.0 |
| [2]Ku | --- | --- | --- | --- | --- | --- | --- |
| Lake Charles: | | | | | | | |
| LcA | 75 | 500 | 90 | 130 | 30 | 6.0 | 10 |
| LcB | 50 | 450 | 85 | --- | 25 | 6.0 | 10 |
| [2]Lu | --- | --- | --- | --- | --- | --- | --- |
| Midland: | | | | | | | |
| Md | 70 | 400 | 65 | 120 | 30 | 6.5 | 9.0 |
| [2]Mu | --- | --- | --- | --- | --- | --- | --- |
| Nahatche: | | | | | | | |
| Na | --- | --- | --- | --- | --- | 5.0 | 9.0 |
| Ozan: | | | | | | | |
| On | --- | --- | --- | --- | 20 | 6.0 | 8.0 |
| [2]Om | --- | --- | --- | --- | --- | --- | --- |

See footnotes at end of table.

TABLE 3.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

| Soil name and map symbol | Corn | Cotton lint | Grain sorghum | Rice | Soybeans | Common bermudagrass | Improved bermudagrass |
|---|---|---|---|---|---|---|---|
| | Bu | Lb | Bu | Bu | Bu | AUM[1] | AUM[1] |
| Segno: | | | | | | | |
| SeA | 70 | 500 | 65 | --- | 25 | 7.0 | 11.0 |
| SeB | 70 | 500 | 60 | --- | --- | 7 | 11 |
| Urban land: Ur. | | | | | | | |
| Vamont: | | | | | | | |
| VaA | 60 | --- | 70 | 120 | 30 | 6.0 | 10.0 |
| VaB | 50 | --- | 65 | --- | 25 | 6.0 | 8.0 |
| [2]Vn | --- | --- | --- | --- | --- | --- | --- |
| Voss: | | | | | | | |
| Vo | --- | --- | --- | --- | --- | --- | 6.0 |
| [2]Vs | --- | --- | --- | --- | --- | --- | --- |
| Wockley: | | | | | | | |
| Wo | 70 | 450 | 65 | 110 | 25 | 6.5 | 10.0 |
| [2]Wy | --- | --- | --- | --- | --- | --- | --- |

[1]Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.
[2]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the soils.

TABLE 4.--RANGE PRODUCTIVITY AND COMPOSITION

[Soils not listed are not in range sites; such soils can be used for grazing if grass cover is established]

| Soil name and map symbol | Range site name | Potential production: Kind of year | Potential production: Dry weight | Common plant name | Composition |
|---|---|---|---|---|---|
| | | | Lbs/ac | | Pct |
| Addicks: | | | | | |
| Ad | Loamy prairie | Favorable | 8,500 | Little bluestem | 50 |
| | | Normal | 6,500 | Indiangrass | 10 |
| | | Unfavorable | 5,000 | Switchgrass | 10 |
| | | | | Eastern gamagrass | 10 |
| | | | | Big bluestem | 5 |
| | | | | Other perennial grasses | 10 |
| | | | | Other perennial forbs | 5 |
| Aris: | | | | | |
| Ap, [1]Ar | Loamy prairie | Favorable | 8,500 | Little bluestem | 45 |
| | | Normal | 6,500 | Indiangrass | 10 |
| | | Unfavorable | 5,000 | Eastern gamagrass | 10 |
| | | | | Switchgrass | 10 |
| | | | | Big bluestem | 5 |
| | | | | Brownseed paspalum | 5 |
| | | | | Unknowns | 5 |
| | | | | Other perennial forbs | 10 |
| Beaumont: | | | | | |
| Bs | Blackland | Favorable | 9,500 | Little bluestem | 55 |
| | | Normal | 7,500 | Indiangrass | 10 |
| | | Unfavorable | 6,500 | Eastern gamagrass | 10 |
| | | | | Switchgrass | 10 |
| | | | | Big bluestem | 5 |
| | | | | Brownseed paspalum | 3 |
| | | | | Florida paspalum | 2 |
| | | | | Knotroot bristlegrass | 1 |
| | | | | Silver bluestem | 1 |
| | | | | Other trees | 3 |
| Bernard: | | | | | |
| Bd, [1]Bo | Blackland | Favorable | 9,000 | Little bluestem | 50 |
| | | Normal | 7,000 | Indiangrass | 10 |
| | | Unfavorable | 6,500 | Eastern gamagrass | 10 |
| | | | | Big bluestem | 5 |
| | | | | Switchgrass | 5 |
| | | | | Florida paspalum | 2 |
| | | | | Virginia wildrye | 2 |
| | | | | Brownseed paspalum | 1 |
| | | | | Other perennial grasslikes | 5 |
| | | | | Other perennial forbs | 5 |
| | | | | Unknowns | 5 |
| Clodine: | | | | | |
| Cd | Lowland | Favorable | 9,000 | Switchgrass | 20 |
| | | Normal | 8,000 | Eastern gamagrass | 15 |
| | | Unfavorable | 7,000 | Maidencane | 15 |
| | | | | Little bluestem | 10 |
| | | | | Florida paspalum | 10 |
| | | | | Panicum | 10 |
| | | | | Indiangrass | 5 |
| | | | | Big bluestem | 5 |
| | | | | Other perennial grasslikes | 10 |
| Edna: | | | | | |
| Ed | Claypan prairie | Favorable | 8,000 | Little bluestem | 50 |
| | | Normal | 6,000 | Indiangrass | 15 |
| | | Unfavorable | 5,000 | Brownseed paspalum | 10 |
| | | | | Florida paspalum | 5 |
| | | | | Other perennial grasses | 4 |
| | | | | Other perennial forbs | 3 |
| | | | | Other annual forbs | 2 |
| | | | | Other trees | 1 |

See footnotes at end of table.

TABLE 4.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

| Soil name and map symbol | Range site name | Potential production: Kind of year | Potential production: Dry weight | Common plant name | Compo- sition |
|---|---|---|---|---|---|
| | | | Lbs/ac | | Pct |
| Gessner: | | | | | |
| Ge, [1]Gs | Lowland | Favorable | 9,000 | Switchgrass | 20 |
| | | Normal | 8,000 | Maidencane | 20 |
| | | Unfavorable | 7,000 | Eastern gamagrass | 15 |
| | | | | Little bluestem | 10 |
| | | | | Indiangrass | 10 |
| | | | | Paspalum | 10 |
| | | | | Panicum | 5 |
| | | | | Other trees | 10 |
| Harris: | | | | | |
| Ha | Salt marsh | Favorable | 14,000 | Marshhay cordgrass | 72 |
| | | Normal | 11,000 | Seashore saltgrass | 6 |
| | | Unfavorable | 8,000 | Seashore paspalum | 6 |
| | | | | Common reed | 4 |
| | | | | Olney bulrush | 4 |
| | | | | Saltmarsh bulrush | 4 |
| | | | | Slim aster | 1 |
| | | | | Sumpweed | 1 |
| | | | | Hairypod cowpea | 1 |
| | | | | Bushysea oxeye | 1 |
| Hockley: | | | | | |
| HoA, HoB | Loamy prairie | Favorable | 8,500 | Little bluestem | 50 |
| | | Normal | 6,000 | Indiangrass | 10 |
| | | Unfavorable | 5,000 | Brownseed paspalum | 10 |
| | | | | Big bluestem | 10 |
| | | | | Florida paspalum | 5 |
| | | | | Other shrubs | 10 |
| | | | | Other perennial forbs | 5 |
| Ijam: | | | | | |
| [1]Is | Salty prairie | Favorable | 10,000 | Gulf cordgrass | 73 |
| | | Normal | 8,500 | Marshhay cordgrass | 5 |
| | | Unfavorable | 7,000 | Common reed | 5 |
| | | | | Switchgrass | 3 |
| | | | | Little bluestem | 2 |
| | | | | Knotroot bristlegrass | 2 |
| | | | | Other annual forbs | 5 |
| | | | | Other perennial grasslikes | 5 |
| Katy: | | | | | |
| Kf | Loamy prairie | Favorable | 8,500 | Little bluestem | 50 |
| | | Normal | 6,500 | Indiangrass | 10 |
| | | Unfavorable | 5,000 | Switchgrass | 10 |
| | | | | Eastern gamagrass | 10 |
| | | | | Big bluestem | 5 |
| | | | | Other trees | 10 |
| | | | | Other perennial forbs | 5 |
| Kenney: | | | | | |
| Kn | Sandy prairie | Favorable | 8,500 | Little bluestem | 40 |
| | | Normal | 6,000 | Crinkleawn | 25 |
| | | Unfavorable | 5,000 | Indiangrass | 10 |
| | | | | Brownseed paspalum | 5 |
| | | | | Pan-American balsamscale | 5 |
| | | | | Gulf muhly | 5 |
| | | | | Fringeleaf paspalum | 2 |
| | | | | Other perennial forbs | 5 |
| | | | | Other perennial grasses | 3 |

See footnotes at end of table.

TABLE 4.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

| Soil name and map symbol | Range site name | Potential production: Kind of year | Potential production: Dry weight | Common plant name | Compo-sition |
|---|---|---|---|---|---|
| | | | Lbs/ac | | Pct |
| Lake Charles: | | | | | |
| LcA, LcB | Blackland | Favorable | 9,500 | Little bluestem | 50 |
| | | Normal | 8,000 | Indiangrass | 10 |
| | | Unfavorable | 6,500 | Eastern gamagrass | 5 |
| | | | | Switchgrass | 5 |
| | | | | Big bluestem | 5 |
| | | | | Brownseed paspalum | 5 |
| | | | | Florida paspalum | 3 |
| | | | | Texas wintergrass | 2 |
| | | | | Unknowns | 10 |
| | | | | Other perennial forbs | 5 |
| Midland: | | | | | |
| Md | Blackland | Favorable | 9,000 | Little bluestem | 50 |
| | | Normal | 7,000 | Indiangrass | 10 |
| | | Unfavorable | 6,500 | Eastern gamagrass | 10 |
| | | | | Switchgrass | 5 |
| | | | | Big bluestem | 5 |
| | | | | Florida paspalum | 2 |
| | | | | Brownseed paspalum | 2 |
| | | | | Silver bluestem | 1 |
| | | | | Other perennial forbs | 5 |
| | | | | Unknowns | 10 |
| Wockley: | | | | | |
| Wo | Loamy prairie | Favorable | 8,500 | Little bluestem | 45 |
| | | Normal | 7,000 | Indiangrass | 10 |
| | | Unfavorable | 5,500 | Eastern gamagrass | 10 |
| | | | | Switchgrass | 10 |
| | | | | Big bluestem | 5 |
| | | | | Brownseed paspalum | 5 |
| | | | | Florida paspalum | 5 |
| | | | | Other perennial grasslikes | 5 |
| | | | | Other trees | 5 |

[1]This mapping unit is made up of two or more dominant soils. See mapping unit description for the composition and behavior of the soils.

TABLE 5.--WOODLAND UNDERSTORY VEGETATION

[Only the soils suitable for production of commercial trees are listed in this table]

| Soil name and map symbol | Potential production: Kind of year | Potential production: Dry weight | Common plant name | Composition |
|---|---|---|---|---|
| | | Lb/acre | | Pct |
| Aldine: | | | | |
| An, [1]An | Favorable | 2,750 | Little bluestem | 20 |
| | Normal | 2,000 | Beaked panicum | 15 |
| | Unfavorable | 1,500 | Longleaf uniola | 10 |
| | | | Purpletop | 5 |
| | | | Brownseed paspalum | 5 |
| | | | Yellow indiangrass | 5 |
| | | | Other trees | 20 |
| | | | Other perennial grasslikes | 10 |
| | | | Other perennial forbs | 10 |
| Aris: | | | | |
| Ap, [1]Ar, [1]As | Favorable | 2,750 | Beaked panicum | 15 |
| | Normal | 2,000 | Virginia wildrye | 15 |
| | Unfavorable | 1,500 | Pinehill bluestem | 15 |
| | | | Carpetgrass | 10 |
| | | | Giant cane | 5 |
| | | | Other perennial grasslikes | 15 |
| | | | Other trees | 15 |
| | | | Unknowns | 10 |
| Atasco: | | | | |
| AtB | Favorable | 2,500 | Little bluestem | 20 |
| | Normal | 1,500 | Beaked panicum | 15 |
| | Unfavorable | 1,000 | Longleaf uniola | 10 |
| | | | Yellow indiangrass | 5 |
| | | | Purpletop | 5 |
| | | | Brownseed paspalum | 5 |
| | | | Other trees | 20 |
| | | | Other perennial grasslikes | 10 |
| | | | Other perennial forbs | 10 |
| Beaumont: | | | | |
| Ba, [1]Bc | Favorable | 3,000 | Little bluestem | 24 |
| | Normal | 2,000 | Rustyseed paspalum | 10 |
| | Unfavorable | 1,500 | Virginia wildrye | 10 |
| | | | Indiangrass | 5 |
| | | | Brownseed paspalum | 5 |
| | | | Switchgrass | 2 |
| | | | American beautyberry | 2 |
| | | | Eastern gamagrass | 1 |
| | | | Yaupon | 1 |
| | | | Greenbrier | 1 |
| | | | Florida paspalum | 1 |
| | | | Other trees | 38 |
| Bernard: | | | | |
| Bd, [1]Be, [1]Bg | Favorable | 3,000 | Little bluestem | 20 |
| | Normal | 2,000 | Virginia wildrye | 10 |
| | Unfavorable | 1,500 | Indiangrass | 5 |
| | | | Big bluestem | 5 |
| | | | Florida paspalum | 5 |
| | | | Brownseed paspalum | 5 |
| | | | Other perennial grasslikes | 20 |
| | | | Other trees | 15 |
| | | | Unknowns | 10 |
| | | | Other perennial forbs | 5 |

See footnotes at end of table.

TABLE 5.--WOODLAND UNDERSTORY VEGETATION--Continued

| Soil name and map symbol | Potential production: Kind of year | Potential production: Dry weight | Common plant name | Composition |
|---|---|---|---|---|
| | | Lb/acre | | Pct |
| Bissonnet: | | | | |
| Bn | Favorable | 2,750 | Beaked panicum | 15 |
| | Normal | 2,000 | Pinehill bluestem | 10 |
| | Unfavorable | 1,500 | Virginia wildrye | 10 |
| | | | Carpetgrass | 10 |
| | | | Panicum | 10 |
| | | | Switchcane | 5 |
| | | | Plumegrass | 5 |
| | | | Other trees | 20 |
| | | | Other perennial grasslikes | 15 |
| Boy: | | | | |
| Bo | Favorable | 2,000 | Pinehill bluestem | 20 |
| | Normal | 1,500 | Beaked panicum | 15 |
| | Unfavorable | 1,000 | Longleaf uniola | 15 |
| | | | Purpletop | 10 |
| | | | American beautyberry | 10 |
| | | | Indiangrass | 5 |
| | | | Greenbrier | 5 |
| | | | Unknowns | 15 |
| | | | Other shrubs | 5 |
| Clodine: | | | | |
| Cd, [1]Ce | Favorable | 2,750 | Little bluestem | 15 |
| | Normal | 2,000 | Beaked panicum | 15 |
| | Unfavorable | 1,500 | Florida paspalum | 10 |
| | | | Panicum | 10 |
| | | | Virginia wildrye | 10 |
| | | | Brownseed paspalum | 5 |
| | | | Other trees | 20 |
| | | | Other perennial grasslikes | 15 |
| Edna: | | | | |
| Ed | Favorable | 2,000 | Little bluestem | 20 |
| | Normal | 1,500 | Longleaf uniola | 15 |
| | Unfavorable | 1,000 | Purpletop | 10 |
| | | | Beaked panicum | 10 |
| | | | Indiangrass | 3 |
| | | | Other perennial grasses | 17 |
| | | | Other perennial grasslikes | 10 |
| | | | Other perennial forbs | 5 |
| | | | Other shrubs | 4 |
| | | | Other annual forbs | 3 |
| | | | Other trees | 3 |
| Gessner: | | | | |
| Ge, [1]Gs, [1]Gu | Favorable | 2,750 | Beaked panicum | 15 |
| | Normal | 2,000 | Little bluestem | 10 |
| | Unfavorable | 1,500 | Panicum | 10 |
| | | | Pinehill bluestem | 10 |
| | | | Carpetgrass | 5 |
| | | | Paspalum | 5 |
| | | | Virginia wildrye | 5 |
| | | | Switchcane | 5 |
| | | | Plumegrass | 5 |
| | | | Other perennial grasslikes | 15 |
| | | | Other trees | 15 |

See footnotes at end of table.

TABLE 5.--WOODLAND UNDERSTORY VEGETATION--Continued

| Soil name and map symbol | Potential production: Kind of year | Potential production: Dry weight | Common plant name | Composition |
|---|---|---|---|---|
| | | Lb/acre | | Pct |
| Hatliff: | | | | |
| Hf | Favorable | 3,000 | Beaked panicum | 15 |
| | Normal | 2,000 | Virginia wildrye | 15 |
| | Unfavorable | 1,500 | Rustyseed paspalum | 15 |
| | | | Longleaf uniola | 10 |
| | | | American beautyberry | 5 |
| | | | Peppervine | 5 |
| | | | Grape | 5 |
| | | | Other perennial grasslikes | 20 |
| | | | Other trees | 10 |
| Hockley: | | | | |
| HoA, HoB | Favorable | 2,500 | Little bluestem | 20 |
| | Normal | 1,750 | Longleaf uniola | 15 |
| | Unfavorable | 1,500 | Virginia wildrye | 10 |
| | | | Beaked panicum | 5 |
| | | | Florida paspalum | 5 |
| | | | Purpletop | 5 |
| | | | Other shrubs | 20 |
| | | | Other perennial forbs | 10 |
| | | | Other perennial grasslikes | 10 |
| Kaman: | | | | |
| Ka | Favorable | 4,500 | Switchcane | 40 |
| | Normal | 4,000 | Virginia wildrye | 10 |
| | Unfavorable | 3,000 | Beaked panicum | 10 |
| | | | Other perennial grasslikes | 20 |
| | | | Other trees | 20 |
| Katy: | | | | |
| Kf | Favorable | 3,000 | Pinehill bluestem | 25 |
| | Normal | 2,000 | Beaked panicum | 25 |
| | Unfavorable | 1,500 | Longleaf uniola | 10 |
| | | | Yellow indiangrass | 5 |
| | | | Brownseed paspalum | 5 |
| | | | Other trees | 20 |
| | | | Other perennial grasslikes | 10 |
| Kenney: | | | | |
| Kn, [1]Ku | Favorable | 2,000 | Little bluestem | 30 |
| | Normal | 1,750 | Indiangrass | 10 |
| | Unfavorable | 1,000 | Brownseed paspalum | 10 |
| | | | Purpletop | 10 |
| | | | Longleaf uniola | 10 |
| | | | Fringeleaf paspalum | 5 |
| | | | Other perennial grasses | 15 |
| | | | Other perennial forbs | 5 |
| | | | Other shrubs | 5 |
| Lake Charles: | | | | |
| LcA, LcB, [1]Lu | Favorable | 3,000 | Little bluestem | 15 |
| | Normal | 2,000 | Virginia wildrye | 10 |
| | Unfavorable | 1,500 | Indiangrass | 7 |
| | | | Brownseed paspalum | 5 |
| | | | Rustyseed paspalum | 5 |
| | | | American beautyberry | 5 |
| | | | Florida paspalum | 3 |
| | | | Texas wintergrass | 3 |
| | | | Big bluestem | 2 |
| | | | Yaupon | 2 |
| | | | Other perennial grasslikes | 25 |
| | | | Unknowns | 13 |
| | | | Other perennial forbs | 5 |

See footnotes at end of table.

TABLE 5.--WOODLAND UNDERSTORY VEGETATION--Continued

| Soil name and map symbol | Potential production: Kind of year | Potential production: Dry weight | Common plant name | Composition |
|---|---|---|---|---|
| | | Lb/acre | | Pct |
| Midland: | | | | |
| Md, [1]Mu | Favorable | 3,000 | Little bluestem | 20 |
| | Normal | 2,000 | Virginia wildrye | 1 |
| | Unfavorable | 1,500 | Indiangrass | |
| | | | Rustyseed paspalum | |
| | | | Brownseed paspalum | |
| | | | Switchgrass | 2 |
| | | | American beautyberry | 2 |
| | | | Eastern gamagrass | 1 |
| | | | Florida paspalum | 1 |
| | | | Yaupon | 1 |
| | | | Greenbrier | 1 |
| | | | Other perennial grasslikes | 15 |
| | | | Other shrubs | 5 |
| | | | Other trees | 27 |
| Nahatche: | | | | |
| Na | Favorable | 3,000 | Virginia wildrye | 20 |
| | Normal | 2,000 | Rustyseed paspalum | 15 |
| | Unfavorable | 1,500 | Beaked panicum | 10 |
| | | | Panicum | 5 |
| | | | Plumegrass | 5 |
| | | | Switchcane | 5 |
| | | | Other perennial grasslikes | 25 |
| | | | Other trees | 15 |
| Ozan: | | | | |
| Oa, [1]On | Favorable | 3,000 | Beaked panicum | 29 |
| | Normal | 2,200 | Native bluestems | 22 |
| | Unfavorable | 1,000 | Low panicum | 11 |
| | | | Switchgrass | 8 |
| | | | Velvetgrass | 8 |
| | | | Uniolas | 8 |
| | | | Other annual forbs | 14 |
| Segno: | | | | |
| SeA, SeB | Favorable | 2,500 | Pinehill bluestem | 17 |
| | Normal | 1,800 | Beaked panicum | 17 |
| | Unfavorable | 1,250 | Longleaf uniola | 17 |
| | | | Purpletop | 7 |
| | | | Yellow indiangrass | 6 |
| | | | Panicum | 6 |
| | | | Other trees | 17 |
| | | | Other perennial forbs | 7 |
| | | | Other perennial grasslikes | 6 |
| Vamont: | | | | |
| VaA, VaB, [1]Vn | Favorable | 3,000 | Little bluestem | 25 |
| | Normal | 2,000 | Virginia wildrye | 15 |
| | Unfavorable | 1,500 | Rustyseed paspalum | 10 |
| | | | Yellow indiangrass | 5 |
| | | | Other perennial forbs | 20 |
| | | | Other trees | 15 |
| | | | Other perennial grasslikes | 10 |

See footnotes at end of table.

TABLE 5.--WOODLAND UNDERSTORY VEGETATION--Continued

| Soil name and map symbol | Potential production: Kind of year | Potential production: Dry weight | Common plant name | Composition |
|---|---|---|---|---|
| | | Lb/acre | | Pct |
| Voss: | | | | |
| Vo, [1]Vs | Favorable | 3,500 | Panicum | 20 |
| | Normal | 2,500 | Virginia wildrye | 10 |
| | Unfavorable | 1,500 | Longleaf uniola | 10 |
| | | | Purpletop | 10 |
| | | | Switchcane | 10 |
| | | | Plumegrass | 3 |
| | | | Switchgrass | 3 |
| | | | Other perennial grasslikes | 20 |
| | | | Other trees | 14 |
| Wockley: | | | | |
| Wo, [1]Wy | Favorable | 2,500 | Pinehill bluestem | 20 |
| | Normal | 1,800 | Beaked panicum | 15 |
| | Unfavorable | 1,000 | Longleaf uniola | 10 |
| | | | Purpletop | 10 |
| | | | Panicum | 10 |
| | | | Yellow indiangrass | 5 |
| | | | Paspalum | 5 |
| | | | Other trees | 15 |
| | | | Other perennial grasslikes | 10 |

[1]This mapping unit is made up of two or more dominant soils. See mapping unit description for the composition and behavior of the soils.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed in this table. Absence of an entry in a column means the information was not available]

| Soil name and map symbol | Ordination symbol | Management concerns: Equipment limitation | Management concerns: Seedling mortality | Management concerns: Plant competition | Potential productivity: Important trees | Potential productivity: Site index | Trees to plant |
|---|---|---|---|---|---|---|---|
| Addicks: | | | | | | | |
| Ad, [1]Ak | 2w9 | Severe | Severe | Severe | Loblolly pine | 90 | Loblolly pine, slash pine. |
| | | | | | Sweetgum | 90 | |
| | | | | | Water oak | --- | |
| | | | | | Southern red oak | 80 | |
| Aldine: | | | | | | | |
| Am, [1]An | 2w9 | Moderate | Slight | Severe | Loblolly pine | 86 | Loblolly pine, slash pine. |
| | | | | | Sweetgum | 86 | |
| | | | | | Southern red oak | 76 | |
| Aris: | | | | | | | |
| Ap, [1]Ar, [1]As | 2w8 | Moderate | Slight | Moderate | Loblolly pine | 90 | Loblolly pine, slash pine. |
| | | | | | Southern red oak | --- | |
| | | | | | Sweetgum | --- | |
| Atasco: | | | | | | | |
| AtB | 2w8 | Moderate | Slight | Slight | Loblolly pine | 90 | Loblolly pine, slash pine. |
| | | | | | Sweetgum | 90 | |
| | | | | | Southern red oak | 80 | |
| Beaumont: | | | | | | | |
| Ba, [1]Bc | 2w9 | Severe | Severe | Severe | Loblolly pine | 90 | Loblolly pine, slash pine. |
| | | | | | Southern red oak | 80 | |
| Bernard: | | | | | | | |
| Bd, [1]Be, [1]Bg | 2w9 | Moderate | Moderate | Severe | Loblolly pine | 90 | Loblolly pine, slash pine. |
| | | | | | Southern red oak | 80 | |
| | | | | | Water oak | 70 | |
| | | | | | Shortleaf pine | 80 | |
| Bissonnet: | | | | | | | |
| Bn | 2w8 | Moderate | Slight | Moderate | Loblolly pine | 86 | Loblolly pine, slash pine. |
| | | | | | Sweetgum | 86 | |
| | | | | | Southern red oak | 80 | |
| Boy: | | | | | | | |
| Bo | 2s2 | Slight | Moderate | Slight | Loblolly pine | 90 | Loblolly pine, slash pine. |
| | | | | | Shortleaf pine | 80 | |
| | | | | | Longleaf pine | 80 | |
| Clodine: | | | | | | | |
| Cd, [1]Ce | 2w9 | Severe | Severe | Severe | Loblolly pine | 90 | Loblolly pine, slash pine. |
| | | | | | Sweetgum | --- | |
| | | | | | Water oak | --- | |
| | | | | | Southern red oak | --- | |
| Edna: | | | | | | | |
| Ed | 2w9 | Severe | Severe | Severe | Loblolly pine | 90 | Loblolly pine, slash pine. |
| | | | | | Southern red oak | 80 | |
| Gessner: | | | | | | | |
| Ge, [1]Ga, [1]Gu | 3w9 | Severe | Severe | Severe | Loblolly pine | 80 | Loblolly pine, slash pine. |
| | | | | | Water oak | 80 | |
| | | | | | Sweetgum | 80 | |
| Hatliff: | | | | | | | |
| Hf | 2w8 | Moderate | Moderate | Moderate | Loblolly pine | 95 | Loblolly pine, slash pine, eastern cottonwood. |
| | | | | | Slash pine | --- | |
| | | | | | Sweetgum | --- | |
| | | | | | Water oak | --- | |
| | | | | | Willow oak | --- | |

See footnotes at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

| Soil name and map symbol | Ordination symbol | Management concerns: Equipment limitation | Management concerns: Seedling mortality | Management concerns: Plant competition | Potential productivity: Important trees | Potential productivity: Site index | Trees to plant |
|---|---|---|---|---|---|---|---|
| Hockley: | | | | | | | |
| HoA, HoB | 2o7 | Slight | Slight | Slight | Loblolly pine | 90 | Loblolly pine, |
| | | | | | Water oak | 90 | slash pine, |
| | | | | | Sweetgum | 90 | sweetgum, |
| | | | | | Southern red oak | 80 | black walnut. |
| Kaman: | | | | | | | |
| Ka | 1w6 | Severe | Severe | Moderate | Baldcypress | 95 | Baldcypress. |
| | | | | | Sweetgum | --- | |
| | | | | | Water oak | --- | |
| Katy: | | | | | | | |
| Kf | 2w8 | Moderate | Slight | Slight | Loblolly pine | 90 | Loblolly pine, |
| | | | | | Shortleaf pine | 80 | slash pine. |
| | | | | | Longleaf pine | 80 | |
| Kenney: | | | | | | | |
| Kn, [1]Ku | 3s2 | Moderate | Moderate | Moderate | Loblolly pine | 80 | Loblolly pine, |
| | | | | | Longleaf pine | 70 | slash pine. |
| Lake Charles: | | | | | | | |
| LcA, LcB, [1]Lu | 2w9 | Severe | Severe | Severe | Loblolly pine | 90 | Loblolly pine, |
| | | | | | Southern red oak | 80 | slash pine. |
| Midland: | | | | | | | |
| Md, [1]Mu | 2w6 | Severe | Moderate | Severe | Green ash | --- | Eastern cottonwood, |
| | | | | | Water oak | 90 | water oak. |
| | | | | | Sweetgum | 90 | |
| | | | | | Eastern cottonwood | --- | |
| Nahatche: | | | | | | | |
| Na | 1w9 | Severe | Moderate | Slight | Water oak | 100 | Eastern cottonwood, |
| | | | | | Willow oak | 100 | water oak. |
| | | | | | Eastern cottonwood | 100 | |
| | | | | | Loblolly pine | 100 | |
| Ozan: | | | | | | | |
| Oa, [1]Os | 2w9 | Severe | Severe | Severe | Loblolly pine | 95 | Loblolly pine, |
| | | | | | Shortleaf pine | --- | Shumard oak, |
| | | | | | Sweetgum | 90 | sweetgum, |
| | | | | | Water oak | 90 | American sycamore, |
| | | | | | Cherrybark oak | --- | eastern cottonwood. |
| | | | | | Shumard oak | --- | |
| | | | | | Eastern cottonwood | --- | |
| Segno: | | | | | | | |
| SeA, SeB | 2o7 | Slight | Slight | Slight | Loblolly pine | 90 | Loblolly pine, |
| | | | | | Longleaf pine | 76 | slash pine, |
| | | | | | Shortleaf pine | 77 | sweetgum. |
| | | | | | Sweetgum | 90 | |
| | | | | | Southern red oak | 80 | |
| Vamont: | | | | | | | |
| VaA, VaB, [1]Vn | 2w9 | Severe | Severe | Severe | Loblolly pine | 90 | Loblolly pine, |
| | | | | | Southern red oak | 80 | slash pine. |
| Voss: | | | | | | | |
| Vo, [1]Vs | 3w8 | Moderate | Moderate | Slight | Loblolly pine | 75 | Loblolly pine, |
| | | | | | Shortleaf pine | 70 | slash pine, |
| | | | | | Longleaf pine | 70 | eastern cottonwood. |
| Wockley: | | | | | | | |
| Wo, [1]Wy | 2w8 | Moderate | Slight | Moderate | Loblolly pine | 90 | Loblolly pine, |
| | | | | | Southern red oak | --- | slash pine. |
| | | | | | Sweetgum | --- | |

[1] This mapping unit is made up of two or more dominant soils. See mapping unit description for the composition and behavior of the soils.

TABLE 7.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not determined]

| Soil name and map symbol | Potential for habitat elements: Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Hardwood trees | Coniferous plants | Wetland plants | Shallow water areas | Potential as habitat for--: Openland wildlife | Woodland wildlife | Wetland wildlife |
|---|---|---|---|---|---|---|---|---|---|---|
| Addicks: | | | | | | | | | | |
| Ad | Fair | Fair | Fair | Fair | Fair | Good | Fair | Fair | Fair | Fair. |
| [1]Ak: | | | | | | | | | | |
| Addicks part | Fair | Fair | Fair | Fair | Fair | Good | Fair | Fair | Fair | Fair. |
| Urban land part. | | | | | | | | | | |
| Aldine: | | | | | | | | | | |
| Am | Fair | Good | Good | Good | Good | Fair | Fair | Good | Good | Fair. |
| [1]An: | | | | | | | | | | |
| Aldine part | Fair | Good | Good | Good | Good | Fair | Fair | Good | Good | Fair. |
| Urban land part. | | | | | | | | | | |
| Aris: | | | | | | | | | | |
| Ap | Fair | Fair | Good | Fair | Fair | Good | Good | Fair | Fair | Good. |
| [1]Ar: | | | | | | | | | | |
| Aris part | Fair | Fair | Good | Fair | Fair | Good | Good | Fair | Fair | Good. |
| Gessner part | Poor | Fair | Fair | Good | Fair | Good | Good | Fair | Good | Good. |
| [1]As: | | | | | | | | | | |
| Aris part | Fair | Fair | Good | Fair | Fair | Good | Good | Fair | Fair | Good. |
| Urban land part. | | | | | | | | | | |
| Atasco: | | | | | | | | | | |
| AtB | Good | Good | Good | Good | Good | Poor | Poor | Good | Good | Poor. |
| Beaumont: | | | | | | | | | | |
| Ba | Fair | Fair | Poor | Fair | Fair | Fair | Good | Fair | Fair | Fair. |
| [1]Bc: | | | | | | | | | | |
| Beaumont part | Fair | Fair | Poor | Fair | Fair | Fair | Good | Fair | Fair | Fair. |
| Urban land part. | | | | | | | | | | |
| Bernard: | | | | | | | | | | |
| Bd | Fair | Good | Fair | Good | Good | Fair | Fair | Fair | Good | Fair. |
| [1]Be: | | | | | | | | | | |
| Bernard part | Fair | Good | Fair | Good | Good | Fair | Fair | Fair | Good | Fair. |
| Edna part | Fair | Fair | Fair | Fair | Fair | Good | Fair | Fair | Fair | Fair. |
| [1]Bg: | | | | | | | | | | |
| Bernard part | Fair | Good | Fair | Good | Good | Fair | Fair | Fair | Good | Fair. |
| Urban land part. | | | | | | | | | | |
| Bissonnet: | | | | | | | | | | |
| Bn | Fair | Good | Good | Good | Good | Fair | Fair | Good | Good | Fair. |
| Boy: | | | | | | | | | | |
| Bo | Fair | Good | Good | Fair | Fair | Poor | Poor | Good | Fair | Poor. |
| Clodine: | | | | | | | | | | |
| Cd | Fair | Fair | Fair | Fair | Fair | Good | Fair | Fair | Fair | Fair. |
| [1]Ce: | | | | | | | | | | |
| Clodine part | Fair | Fair | Fair | Fair | Fair | Good | Fair | Fair | Fair | Fair. |

See footnotes at end of table.

TABLE 7.--WILDLIFE HABITAT POTENTIALS--Continued

| Soil name and map symbol | Potential for habitat elements | | | | | | | Potential as habitat for-- | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herba- ceous plants | Hard- wood trees | Conif- erous plants | Wetland plants | Shallow water areas | Open- land wild- life | Wood- land wild- life | Wetland wild- life |
| Clodine: Urban land part. | | | | | | | | | | |
| Edna: Ed | Fair | Fair | Fair | Fair | Fair | Good | Good | Fair | Fair | Good. |
| Gessner: Ge, [1]Gs | Poor | Fair | Fair | Good | Fair | Good | Good | Fair | Good | Good. |
| [1]Gu: Gessner part | Poor | Fair | Fair | Good | Fair | Good | Good | Fair | Good | Good. |
| Urban land part. | | | | | | | | | | |
| Harris: Ha | Very poor. | Very poor. | Poor | Very poor. | Very poor. | Good | Good | Very poor. | Very poor. | Good. |
| Hatliff: Hf | Fair | Fair | Fair | Good | Good | Fair | Poor | Fair | Good | Poor. |
| Hockley: HoA, HoB | Good | Good | Good | Good | Good | Poor | Fair | Good | Good | Poor. |
| Ijam: [1]Is | Very poor. | Very poor. | Poor | Very poor. | Very poor. | Good | Good | Very poor. | Very poor. | Good. |
| Kaman: Ka | Poor | Fair | Poor | Fair | Poor | Poor | Good | Poor | Fair | Fair. |
| Katy: Kf | Fair | Good | Good | Good | Good | Fair | Fair | Good | Good | Fair. |
| Kenney: Kn | Poor | Fair | Fair | Fair | Fair | Poor | Very poor. | Poor | Fair | Very poor. |
| [1]Ku: Kenney part | Poor | Fair | Fair | Fair | Fair | Poor | Very poor. | Poor | Fair | Very poor. |
| Urban land part. | | | | | | | | | | |
| Lake Charles: LcA | Fair | Fair | Fair | Good | Good | Fair | Good | Fair | Good | Fair. |
| LcB | Fair | Fair | Fair | Good | Good | Fair | Poor | Fair | Good | Poor. |
| [1]Lu: Lake Charles part | Fair | Fair | Fair | Good | Good | Fair | Good | Fair | Good | Fair. |
| Urban land part. | | | | | | | | | | |
| Midland: Md | Poor | Fair | Fair | Fair | Fair | Good | Good | Fair | Fair | Good. |
| [1]Mu: Midland part | Poor | Fair | Fair | Fair | Fair | Good | Good | Fair | Fair | Good. |
| Urban land part. | | | | | | | | | | |
| Nahatche: Na | Very poor. | Poor | Fair | Good | Good | Fair | Fair | Poor | Fair | Fair. |
| Ozan: Oa | Poor | Fair | Fair | Fair | Fair | Good | Good | Fair | Fair | Good. |

See footnotes at end of table.

TABLE 7.--WILDLIFE HABITAT POTENTIALS--Continued

| Soil name and map symbol | Potential for habitat elements: Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Hardwood trees | Coniferous plants | Wetland plants | Shallow water areas | Potential as habitat for--: Openland wildlife | Woodland wildlife | Wetland wildlife |
|---|---|---|---|---|---|---|---|---|---|---|
| Ozan: | | | | | | | | | | |
| [1]On: | | | | | | | | | | |
| Ozan part | Poor | Fair | Fair | Fair | Fair | Good | Good | Fair | Fair | Good. |
| Urban land part. | | | | | | | | | | |
| Segno: | | | | | | | | | | |
| SeA, SeB | Good | Good | Good | Good | Good | Poor | Poor | Good | Good | Poor. |
| Urban land: | | | | | | | | | | |
| Ur. | | | | | | | | | | |
| Vamont: | | | | | | | | | | |
| VaA | Fair | Fair | Poor | Fair | Fair | Fair | Good | Fair | Fair | Fair. |
| VaB | Fair | Fair | Poor | Fair | Fair | Poor | Very poor. | Fair | Fair | Very poor. |
| [1]Vn: | | | | | | | | | | |
| Vamont part | Fair | Fair | Poor | Fair | Fair | Poor | Very poor. | Fair | Fair | Very poor. |
| Urban land part. | | | | | | | | | | |
| Voss: | | | | | | | | | | |
| Vo, [1]Vs | Poor | Fair | Fair | Poor | Fair | Poor | Very poor. | Fair | Poor | Very poor. |
| Wockley: | | | | | | | | | | |
| Wo | Fair | Good | Good | Good | Good | Fair | Fair | Good | Good | Fair. |
| [1]Wy: | | | | | | | | | | |
| Wockley part | Fair | Good | Good | Good | Good | Fair | Fair | Good | Good | Fair. |
| Urban land part. | | | | | | | | | | |

[1]This mapping unit is made up of two or more dominant soils. See mapping unit description for the composition and behavior of the soils.

TABLE 8.--RECREATIONAL DEVELOPMENT

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| Addicks: Ad | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| [1]Ak: Addicks part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| [2]Urban land part. | | | | |
| Aldine: Am | Severe: wetness, percs slowly. | Moderate: wetness. | Severe: wetness, percs slowly. | Moderate: wetness. |
| [1]An: Aldine part | Severe: wetness, percs slowly. | Moderate: wetness. | Severe: wetness, percs slowly. | Moderate: wetness. |
| [2]Urban land part. | | | | |
| Aris: Ap | Severe: wetness, percs slowly. | Severe: wetness. | Severe: wetness, percs slowly. | Severe: wetness. |
| [1]Ar: Aris part | Severe: wetness, percs slowly. | Severe: wetness. | Severe: wetness, percs slowly. | Severe: wetness. |
| Gessner part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| [1]As: Aris part | Severe: wetness, percs slowly. | Severe: wetness. | Severe: wetness, percs slowly. | Severe: wetness. |
| [2]Urban land part. | | | | |
| Atasco: AtB | Severe: percs slowly. | Slight | Severe: percs slowly. | Slight. |
| Beaumont: Ba | Severe: wetness, too clayey, percs slowly. | Severe: wetness, too clayey. | Severe: wetness, too clayey, percs slowly. | Severe: wetness, too clayey. |
| [1]Bc: Beaumont part | Severe: wetness, too clayey, percs slowly. | Severe: wetness, too clayey. | Severe: wetness, too clayey, percs slowly. | Severe: wetness, too clayey. |
| [2]Urban land part. | | | | |
| Bernard: Bd | Severe: wetness, percs slowly. | Moderate: wetness, too clayey. | Severe: wetness, percs slowly. | Moderate: wetness, too clayey. |

See footnotes at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| Bernard: | | | | |
| [1]Be: | | | | |
| Bernard part | Severe: wetness, percs slowly. | Moderate: wetness, too clayey. | Severe: wetness, percs slowly. | Moderate: wetness, too clayey. |
| Edna part | Severe: wetness, percs slowly. | Severe: wetness. | Severe: wetness, percs slowly. | Severe: wetness. |
| [1]Bg: | | | | |
| Bernard part | Severe: wetness, percs slowly. | Moderate: wetness, too clayey. | Severe: wetness, percs slowly. | Moderate: wetness, too clayey. |
| [2]Urban land part. | | | | |
| Bissonnet: | | | | |
| Bn | Moderate: wetness. | Moderate: wetness. | Moderate: wetness. | Moderate: wetness. |
| Boy: | | | | |
| Bo | Moderate: too sandy. | Moderate: too sandy. | Moderate: too sandy. | Moderate: too sandy. |
| Clodine: | | | | |
| Cd | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| [1]Ce: | | | | |
| Clodine part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| [2]Urban land part. | | | | |
| Edna: | | | | |
| Ed | Severe: wetness, percs slowly. | Severe: wetness. | Severe: wetness, percs slowly. | Severe: wetness. |
| Gessner: | | | | |
| Ge, [1]Gs | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| [1]Gu: | | | | |
| Gessner part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| [2]Urban land part. | | | | |
| Harris: | | | | |
| Ha | Severe: wetness, too clayey, floods. | Severe: wetness, too clayey, floods. | Severe: wetness, too clayey, floods. | Severe: wetness, too clayey, floods. |
| Hatliff: | | | | |
| Hf | Moderate: wetness, too sandy. | Moderate: wetness, too sandy. | Severe: floods. | Moderate: floods. |
| Hockley: | | | | |
| HoA | Slight | Slight | Slight | Slight. |
| HoB | Slight | Slight | Moderate: slope. | Slight. |

See footnotes at end of table.

TABLE 5.--RECREATIONAL DEVELOPMENT--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| Ijam: | | | | |
| [1]Is | Severe: wetness, percs slowly, too clayey. | Severe: wetness, too clayey. | Severe: wetness, percs slowly, too clayey. | Severe: wetness, too clayey. |
| Kaman: | | | | |
| Ka | Severe: floods, wetness, too clayey. | Severe: floods, too clayey, wetness. | Severe: floods, too clayey, wetness. | Severe: floods, too clayey, wetness. |
| Katy: | | | | |
| Kf | Severe: wetness, percs slowly. | Moderate: wetness. | Severe: wetness, percs slowly. | Moderate: wetness. |
| Kenney: | | | | |
| Kn | Moderate: too sandy. | Moderate: too sandy. | Moderate: too sandy. | Moderate: too sandy. |
| [1]Ku: | | | | |
| Kenney part | Moderate: too sandy. | Moderate: too sandy. | Moderate: too sandy. | Moderate: too sandy. |
| [2]Urban land part. | | | | |
| Lake Charles: | | | | |
| LcA, LcB | Severe: too clayey, wetness, percs slowly. | Severe: too clayey. | Severe: wetness, percs slowly, too clayey. | Severe: too clayey. |
| [1]Lu: | | | | |
| Lake Charles part | Severe: too clayey, wetness, percs slowly. | Severe: too clayey. | Severe: wetness, percs slowly, too clayey. | Severe: too clayey. |
| [2]Urban land part. | | | | |
| Midland: | | | | |
| Md | Severe: wetness, percs slowly. | Severe: wetness. | Severe: wetness, percs slowly. | Severe: wetness. |
| [1]Mu: | | | | |
| Midland part | Severe: wetness, percs slowly. | Severe: wetness. | Severe: wetness, percs slowly. | Severe: wetness. |
| [2]Urban land part. | | | | |
| Nahatche: | | | | |
| Na | Severe: floods, wetness. | Moderate: floods, wetness. | Severe: floods, wetness. | Moderate: floods, wetness. |
| Ozan: | | | | |
| Oa | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| [1]On: | | | | |
| Ozan part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| [2]Urban land part. | | | | |

See footnotes at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| Segno: | | | | |
| SeA, SeB | Moderate: percs slowly. | Slight | Moderate: percs slowly. | Slight. |
| [2]Urban land: Ur. | | | | |
| Vamont: | | | | |
| VaA, VaB | Severe: too clayey, percs slowly. | Severe: too clayey. | Severe: too clayey, percs slowly. | Severe: too clayey. |
| [1]Vn: | | | | |
| Vamont part | Severe: too clayey, percs slowly. | Severe: too clayey. | Severe: too clayey, percs slowly. | Severe: too clayey. |
| [2]Urban land part. | | | | |
| Voss: | | | | |
| Vo, [1]Vs | Severe: floods, too sandy. | Severe: too sandy. | Severe: floods, too sandy. | Severe: floods, too sandy. |
| Wockley: | | | | |
| Wo | Severe: wetness, percs slowly. | Moderate: wetness. | Severe: wetness, percs slowly. | Moderate: wetness. |
| [1]Wy: | | | | |
| Wockley part | Severe: wetness, percs slowly. | Moderate: wetness. | Severe: wetness, percs slowly. | Moderate: wetness. |
| [2]Urban land part. | | | | |

[1]This mapping unit is made up of two or more dominant soils. See mapping unit description for the composition and behavior of the soils.
[2]No interpretations. Material too variable.

TABLE 9.--SANITARY FACILITIES

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil or mapping unit was not rated]

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Addicks: | | | | | |
| Ad | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Poor: wetness. |
| [1]Ak: | | | | | |
| Addicks part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Poor: wetness. |
| Urban land part. | | | | | |
| Aldine: | | | | | |
| An | Severe: wetness, percs slowly. | Slight | Severe: wetness. | Severe: wetness. | Poor: thin layer. |
| [1]An: | | | | | |
| Aldine part | Severe: wetness, percs slowly. | Slight | Severe: wetness. | Severe: wetness. | Poor: thin layer. |
| Urban land part. | | | | | |
| Aris: | | | | | |
| Ap | Severe: percs slowly, wetness. | Slight | Severe: wetness. | Severe: wetness. | Poor: wetness. |
| [1]Ar: | | | | | |
| Aris part | Severe: percs slowly, wetness. | Slight | Severe: wetness. | Severe: wetness. | Poor: wetness. |
| Gessner part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Poor: wetness. |
| [1]As: | | | | | |
| Aris part | Severe: percs slowly, wetness. | Slight | Severe: wetness. | Severe: wetness. | Poor: wetness. |
| Urban land part. | | | | | |
| Atasco: | | | | | |
| AtB | Severe: percs slowly, wetness. | Moderate: slope. | Slight | Slight | Good. |
| Beaumont: | | | | | |
| Ba | Severe: percs slowly, wetness. | Moderate: excess humus. | Severe: wetness, too clayey. | Severe: wetness. | Poor: wetness, too clayey. |
| [1]Bc: | | | | | |
| Beaumont part | Severe: percs slowly, wetness. | Moderate: excess humus. | Severe: wetness, too clayey. | Severe: wetness. | Poor: wetness, too clayey. |
| Urban land part. | | | | | |
| Bernard: | | | | | |
| Bd | Severe: wetness, percs slowly. | Moderate: excess humus. | Severe: wetness, too clayey. | Severe: wetness. | Poor: too clayey. |

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Bernard: | | | | | |
| [1]Be: | | | | | |
| Bernard part | Severe: wetness, percs slowly. | Moderate: excess humus. | Severe: wetness, too clayey. | Severe: wetness. | Poor: too clayey. |
| Edna part | Severe: percs slowly, wetness. | Slight | Severe: wetness, too clayey. | Severe: wetness. | Poor: too clayey, wetness. |
| [1]Bg: | | | | | |
| Bernard part | Severe: wetness, percs slowly. | Moderate: excess humus. | Severe: wetness, too clayey. | Severe: wetness. | Poor: too clayey. |
| Urban land part. | | | | | |
| Bissonnet: | | | | | |
| Bn | Severe: wetness, percs slowly. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Fair: wetness. |
| Boy: | | | | | |
| Bo | Severe: percs slowly, wetness. | Severe: seepage, wetness. | Severe: wetness. | Moderate: wetness. | Fair: too sandy. |
| Clodine: | | | | | |
| Cd | Severe: wetness, percs slowly. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Poor: wetness. |
| [1]Ce: | | | | | |
| Clodine part | Severe: wetness, percs slowly. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Poor: wetness. |
| Urban land part. | | | | | |
| Edna: | | | | | |
| Ed | Severe: percs slowly, wetness. | Slight | Severe: wetness, too clayey. | Severe: wetness. | Poor: too clayey, wetness. |
| Gessner: | | | | | |
| Ge, [1]Gs | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Poor: wetness. |
| [1]Gu: | | | | | |
| Gessner part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Poor: wetness. |
| Urban land part. | | | | | |
| Harris: | | | | | |
| Ha | Severe: percs slowly, wetness, floods. | Severe: floods, excess humus, wetness. | Severe: wetness, floods, too clayey. | Severe: wetness, floods. | Poor: too clayey, wetness. |
| Hatliff: | | | | | |
| Hf | Severe: floods, wetness. | Severe: floods, wetness, seepage. | Severe: floods, wetness, seepage. | Severe: floods, wetness, seepage. | Fair: too sandy. |
| Hockley: | | | | | |
| HoA, HoB | Severe: percs slowly. | Moderate: wetness. | Moderate: wetness. | Moderate: wetness. | Good. |

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Ijam: | | | | | |
| [1]Is | Severe: percs slowly, wetness. | Slight | Severe: wetness, too clayey. | Severe: wetness. | Poor: too clayey, wetness. |
| Kaman: | | | | | |
| Ka | Severe: floods, wetness, percs slowly. | Moderate: excess humus. | Severe: floods, too clayey, wetness. | Severe: floods, wetness. | Poor: too clayey, wetness. |
| Katy: | | | | | |
| Kf | Severe: percs slowly, wetness. | Slight | Moderate: wetness. | Moderate: wetness. | Fair: thin layer. |
| Kenney: | | | | | |
| Kn | Slight | Severe: seepage. | Moderate: too sandy. | Severe: seepage. | Fair: too sandy. |
| [1]Ku: | | | | | |
| Kenney part | Slight | Severe: seepage. | Moderate: too sandy. | Severe: seepage. | Fair: too sandy. |
| Urban land part. | | | | | |
| Lake Charles: | | | | | |
| LcA | Severe: percs slowly, wetness. | Slight | Severe: too clayey, wetness. | Severe: wetness. | Poor: too clayey. |
| LcB | Severe: percs slowly, wetness. | Moderate: slope. | Severe: too clayey, wetness. | Severe: wetness. | Poor: too clayey. |
| [1]Lu: | | | | | |
| Lake Charles part | Severe: percs slowly, wetness. | Slight | Severe: too clayey, wetness. | Severe: wetness. | Poor: too clayey. |
| Urban land part. | | | | | |
| Midland: | | | | | |
| Md | Severe: percs slowly, wetness. | Slight | Severe: too clayey, wetness. | Severe: wetness. | Poor: too clayey, wetness. |
| [1]Mu: | | | | | |
| Midland part | Severe: percs slowly, wetness. | Slight | Severe: too clayey, wetness. | Severe: wetness. | Poor: too clayey, wetness. |
| Urban land part. | | | | | |
| Nahatche: | | | | | |
| Na | Severe: floods, wetness. | Severe: floods, wetness. | Severe: floods, wetness. | Severe: floods, wetness. | Fair: wetness. |
| Ozan: | | | | | |
| Oa | Severe: wetness, percs slowly. | Slight | Severe: wetness. | Severe: wetness. | Poor: wetness. |
| [1]On: | | | | | |
| Ozan part | Severe: wetness, percs slowly. | Slight | Severe: wetness. | Severe: wetness. | Poor: wetness. |
| Urban land part. | | | | | |

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Segno: | | | | | |
| SeA | Severe: percs slowly, wetness. | Slight | Moderate: wetness. | Moderate: wetness. | Good. |
| SeB | Severe: percs slowly, wetness. | Moderate: slope. | Moderate: wetness. | Moderate: wetness. | Good. |
| Urban land: Ur. | | | | | |
| Vamont: | | | | | |
| VaA | Severe: wetness, percs slowly. | Slight | Severe: too clayey, wetness. | Severe: wetness. | Poor: too clayey. |
| VaB | Severe: wetness, percs slowly. | Moderate: slope. | Severe: too clayey, wetness. | Severe: wetness. | Poor: too clayey. |
| [1]Vn: | | | | | |
| Vamont part | Severe: wetness, percs slowly. | Moderate: slope. | Severe: too clayey, wetness. | Severe: wetness. | Poor: too clayey. |
| Urban land part. | | | | | |
| Voss: | | | | | |
| Vo, [1]Vs | Severe: floods, wetness. | Severe: floods, seepage, wetness. | Severe: floods, seepage, too sandy. | Severe: floods, seepage. | Poor: seepage, too sandy. |
| Wockley: | | | | | |
| Wo | Severe: percs slowly, wetness. | Slight | Moderate: wetness. | Moderate: wetness. | Fair: thin layer. |
| [1]Wy: | | | | | |
| Wockley part | Severe: percs slowly, wetness. | Slight | Moderate: wetness. | Moderate: wetness. | Fair: thin layer. |
| Urban land part. | | | | | |

[1]This mapping unit is made up of two or more dominant soils. See mapping unit description for the composition and behavior of the soils.

TABLE 10.--BUILDING SITE DEVELOPMENT

[No interpretations made for Urban land, properties are too variable. "Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe."]

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|
| Addicks: | | | | | |
| Ad | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness, corrosive. | Severe: wetness, low strength. |
| [1]Ak: | | | | | |
| Addicks part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness, corrosive. | Severe: wetness, low strength. |
| Urban land part. | | | | | |
| Aldine: | | | | | |
| Am | Severe: wetness. | Moderate: wetness. | Severe: wetness. | Moderate: wetness. | Severe: shrink-swell. |
| [1]An: | | | | | |
| Aldine part | Severe: wetness. | Moderate: wetness. | Severe: wetness. | Moderate: wetness. | Severe: shrink-swell. |
| Urban land part. | | | | | |
| Aris: | | | | | |
| Ap | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: corrosive, wetness. | Severe: wetness, low strength. |
| [1]Ar: | | | | | |
| Aris part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: corrosive, wetness. | Severe: wetness, low strength. |
| Gessner part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness, corrosive. | Severe: wetness, low strength. |
| [1]As: | | | | | |
| Aris part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: corrosive, wetness. | Severe: wetness, low strength. |
| Urban land part. | | | | | |
| Atasco: | | | | | |
| AtB | Severe: wetness. | Moderate: low strength. | Moderate: low strength, wetness. | Moderate: low strength. | Severe: low strength. |
| Beaumont: | | | | | |
| Ba | Severe: wetness, too clayey. | Severe: wetness, low strength, shrink-swell. | Severe: wetness, low strength, shrink-swell. | Severe: wetness, corrosive, shrink-swell. | Severe: wetness, low strength, shrink-swell. |
| [1]Bc: | | | | | |
| Beaumont part | Severe: wetness, too clayey. | Severe: wetness, low strength, shrink-swell. | Severe: wetness, low strength, shrink-swell. | Severe: wetness, corrosive, shrink-swell. | Severe: wetness, low strength, shrink-swell. |
| Urban land part. | | | | | |

See footnotes at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|
| Bernard: | | | | | |
| Bd | Severe: wetness, too clayey. | Severe: wetness, shrink-swell, low strength. | Severe: wetness, shrink-swell, low strength. | Severe: wetness, shrink-swell, corrosive. | Severe: shrink-swell, low strength. |
| [1]Be: | | | | | |
| Bernard part | Severe: wetness, too clayey. | Severe: wetness, shrink-swell, low strength. | Severe: wetness, shrink-swell, low strength. | Severe: wetness, shrink-swell, corrosive. | Severe: shrink-swell, low strength. |
| Edna part | Severe: wetness, too clayey. | Severe: wetness, shrink-swell, low strength. | Severe: wetness, shrink-swell, low strength. | Severe: wetness, corrosive, shrink-swell. | Severe: wetness, shrink-swell, low strength. |
| [1]Bg: | | | | | |
| Bernard part | Severe: wetness, too clayey. | Severe: wetness, shrink-swell, low strength. | Severe: wetness, shrink-swell, low strength. | Severe: wetness, shrink-swell, corrosive. | Severe: shrink-swell, low strength. |
| Urban land part. | | | | | |
| Bissonnet: | | | | | |
| Bn | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: low strength. |
| Boy: | | | | | |
| Bo | Severe: too sandy, wetness. | Moderate: wetness. | Severe: wetness. | Moderate: wetness. | Moderate: wetness. |
| Clodine: | | | | | |
| Cd | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness, corrosive. | Severe: wetness. |
| [1]Ce: | | | | | |
| Clodine part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness, corrosive. | Severe: wetness. |
| Urban land part. | | | | | |
| Edna: | | | | | |
| Ed | Severe: wetness, too clayey. | Severe: wetness, shrink-swell, low strength. | Severe: wetness, shrink-swell, low strength. | Severe: wetness, corrosive, shrink-swell. | Severe: wetness, shrink-swell, low strength. |
| Gessner: | | | | | |
| Ge, [1]Gs | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness, corrosive. | Severe: wetness, low strength. |
| [1]Gu: | | | | | |
| Gessner part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness, corrosive. | Severe: wetness, low strength. |
| Urban land part. | | | | | |
| Harris: | | | | | |
| Ha | Severe: wetness, too clayey, floods. | Severe: wetness, low strength, floods. | Severe: wetness, low strength, floods. | Severe: wetness, corrosive, floods. | Severe: wetness, low strength, floods. |

See footnotes at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|
| Hatliff: | | | | | |
| Hf | Severe: floods, wetness. | Severe: floods, wetness. | Severe: floods, wetness. | Severe: floods, wetness. | Severe: floods, wetness. |
| Hockley: | | | | | |
| HoA, HoB | Moderate: wetness. | Moderate: low strength. | Moderate: low strength, wetness. | Moderate: low strength. | Moderate: low strength. |
| Ijam: | | | | | |
| [1]Is | Severe: wetness, too clayey. | Severe: wetness, low strength, shrink-swell. | Severe: wetness, low strength, shrink-swell. | Severe: wetness, low strength, shrink-swell. | Severe: wetness, low strength, shrink-swell. |
| Kaman: | | | | | |
| Ka | Severe: floods, too clayey, wetness. | Severe: floods, wetness, shrink-swell. | Severe: floods, wetness, shrink-swell. | Severe: corrosive, floods, shrink-swell. | Severe: floods, low strength, shrink-swell. |
| Katy: | | | | | |
| Kf | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness, corrosive. | Severe: low strength. |
| Kenney: | | | | | |
| Kn | Severe: too sandy. | Slight | Slight | Slight | Slight. |
| [1]Ku: | | | | | |
| Kenney part | Severe: too sandy. | Slight | Slight | Slight | Slight. |
| Urban land part. | | | | | |
| Lake Charles: | | | | | |
| LcA, LcB | Severe: too clayey, wetness. | Severe: wetness, low strength, shrink-swell. | Severe: wetness, low strength, shrink-swell. | Severe: wetness, low strength, shrink-swell. | Severe: shrink-swell, low strength. |
| [1]Lu: | | | | | |
| Lake Charles part | Severe: too clayey, wetness. | Severe: wetness, low strength, shrink-swell. | Severe: wetness, low strength, shrink-swell. | Severe: wetness, low strength, shrink-swell. | Severe: shrink-swell, low strength. |
| Urban land part. | | | | | |
| Midland: | | | | | |
| Md | Severe: too clayey, wetness. | Severe: shrink-swell, low strength, wetness. | Severe: shrink-swell, low strength, wetness. | Severe: shrink-swell, low strength, wetness. | Severe: shrink-swell, low strength, wetness. |
| [1]Mu: | | | | | |
| Midland part | Severe: too clayey, wetness. | Severe: shrink-swell, low strength, wetness. | Severe: shrink-swell, low strength, wetness. | Severe: shrink-swell, low strength, wetness. | Severe: shrink-swell, low strength, wetness. |
| Urban land part. | | | | | |
| Nahatche: | | | | | |
| Na | Severe: floods, wetness. | Severe: floods, wetness. | Severe: floods, wetness. | Severe: floods, wetness. | Severe: floods, wetness, low strength. |

See footnotes at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|
| Ozan: | | | | | |
| Oa | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| [1]On: | | | | | |
| Ozan part | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. |
| Urban land part. | | | | | |
| Segno: | | | | | |
| SeA, SeB | Moderate: wetness. | Moderate: wetness. | Moderate: wetness. | Moderate: wetness. | Moderate: low strength. |
| Urban land: Ur. | | | | | |
| Vamont: | | | | | |
| VaA, VaB | Severe: too clayey, wetness. | Severe: shrink-swell, low strength. | Severe: wetness, shrink-swell, low strength. | Severe: corrosive, low strength, shrink-swell. | Severe: low strength, shrink-swell. |
| [1]Vn: | | | | | |
| Vamont part | Severe: too clayey, wetness. | Severe: shrink-swell, low strength. | Severe: wetness, shrink-swell, low strength. | Severe: corrosive, low strength, shrink-swell. | Severe: low strength, shrink-swell. |
| Urban land part. | | | | | |
| Voss: | | | | | |
| Vo, [1]Vs | Severe: floods. | Severe: floods. | Severe: floods, wetness. | Severe: floods, wetness. | Severe: floods. |
| Wockley: | | | | | |
| Wo | Severe: wetness. | Moderate: wetness. | Severe: wetness. | Severe: corrosive, wetness. | Moderate: wetness. |
| [1]Wy: | | | | | |
| Wockley part | Severe: wetness. | Moderate: wetness. | Severe: wetness. | Severe: corrosive, wetness. | Moderate: wetness. |
| Urban land part. | | | | | |

[1]This mapping unit is made up of two or more dominant soils. See mapping unit description for the composition and behavior of the soils.

TABLE 11.--CONSTRUCTION MATERIALS

[No suitability determined for Urban land; properties are too variable. "Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited."]

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Addicks: | | | | |
| Ad | Poor: wetness, low strength. | Unsuited | Unsuited | Poor: wetness. |
| [1]Ax: | | | | |
| Addicks part | Poor: wetness, low strength. | Unsuited | Unsuited | Poor: wetness. |
| Urban land part. | | | | |
| Aldine: | | | | |
| Am | Poor: low strength. | Unsuited | Unsuited | Good. |
| [1]An: | | | | |
| Aldine part | Poor: low strength. | Unsuited | Unsuited | Good. |
| Urban land part. | | | | |
| Aris: | | | | |
| Ap | Poor: wetness, low strength. | Unsuited | Unsuited | Poor: wetness. |
| [1]Ar: | | | | |
| Aris part | Poor: wetness, low strength. | Unsuited | Unsuited | Poor: wetness. |
| Gessner part | Poor: wetness, low strength. | Unsuited | Unsuited | Poor: wetness. |
| [1]As: | | | | |
| Aris part | Poor: wetness, low strength. | Unsuited | Unsuited | Poor: wetness. |
| Urban land part. | | | | |
| Atasco: | | | | |
| AtB | Poor: low strength. | Unsuited | Unsuited | Fair: thin layer. |
| Beaumont: | | | | |
| Ba | Poor: low strength, wetness, shrink-swell. | Unsuited | Unsuited | Poor: wetness, too clayey. |
| [1]Bc: | | | | |
| Beaumont part | Poor: low strength, wetness, shrink-swell. | Unsuited | Unsuited | Poor: wetness, too clayey. |
| Urban land part. | | | | |
| Bernard: | | | | |
| Bd | Poor: low strength, shrink-swell. | Unsuited | Unsuited | Poor: too clayey. |

See footnotes at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Bernard: | | | | |
| [1]Be: | | | | |
| Bernard part | Poor: low strength, shrink-swell. | Unsuited | Unsuited | Poor: too clayey. |
| Edna part | Poor: wetness, shrink-swell, low strength. | Unsuited | Unsuited | Poor: wetness. |
| [1]Bg: | | | | |
| Bernard part | Poor: low strength, shrink-swell. | Unsuited | Unsuited | Poor: too clayey. |
| Urban land part. | | | | |
| Bissonnet: | | | | |
| Bn | Poor: low strength. | Unsuited | Unsuited | Poor: wetness. |
| Boy: | | | | |
| Bo | Fair: wetness. | Poor: excess fines | Unsuited | Poor: too sandy. |
| Clodine: | | | | |
| Cd | Poor: wetness. | Unsuited | Unsuited | Poor: wetness. |
| [1]Ce: | | | | |
| Clodine part | Poor: wetness. | Unsuited | Unsuited | Poor: wetness. |
| Urban land part. | | | | |
| Edna: | | | | |
| Ed | Poor: wetness, shrink-swell, low strength. | Unsuited | Unsuited | Poor: wetness. |
| Gessner: | | | | |
| Ge, [1]Gs | Poor: wetness, low strength. | Unsuited | Unsuited | Poor: wetness. |
| [1]Gu: | | | | |
| Gessner part | Poor: wetness, low strength. | Unsuited | Unsuited | Poor: wetness. |
| Urban land part. | | | | |
| Harris: | | | | |
| Ha | Poor: wetness, low strength, shrink-swell. | Unsuited | Unsuited | Poor: wetness, too clayey, excess salt. |
| Hatliff: | | | | |
| Hf | Good | Fair: excess fines | Unsuited | Poor: too sandy. |
| Hockley: | | | | |
| HoA, HoB | Fair: low strength. | Unsuited | Unsuited | Good. |

See footnotes at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Ijam: | | | | |
| [1]Is | Poor: low strength, shrink-swell, wetness. | Unsuited | Unsuited | Poor: wetness, too clayey, excess salt. |
| Kaman: | | | | |
| Ka | Poor: low strength, shrink-swell, wetness. | Unsuited | Unsuited | Poor: too clayey, wetness. |
| Katy: | | | | |
| Kf | Poor: low strength. | Unsuited | Unsuited | Good. |
| Kenney: | | | | |
| Kn | Good | Poor: excess fines | Unsuited | Poor: too sandy. |
| [1]Ku: | | | | |
| Kenney part | Good | Poor: excess fines | Unsuited | Poor: too sandy. |
| Urban land part. | | | | |
| Lake Charles: | | | | |
| LcA, LcB | Poor: low strength, shrink-swell. | Unsuited | Unsuited | Poor: too clayey. |
| [1]Lu: | | | | |
| Lake Charles part | Poor: low strength, shrink-swell. | Unsuited | Unsuited | Poor: too clayey. |
| Urban land part. | | | | |
| Midland: | | | | |
| Md | Poor: shrink-swell, low strength, wetness. | Unsuited | Unsuited | Poor: thin layer. |
| [1]Mu: | | | | |
| Midland part | Poor: shrink-swell, low strength, wetness. | Unsuited | Unsuited | Poor: thin layer. |
| Urban land part. | | | | |
| Nahatche: | | | | |
| Na | Poor: low strength, wetness. | Unsuited | Unsuited | Fair: too clayey, wetness. |
| Ozan: | | | | |
| Oa | Poor: wetness. | Unsuited | Unsuited | Poor: wetness. |
| [1]On: | | | | |
| Ozan part | Poor: wetness. | Unsuited | Unsuited | Poor: wetness. |
| Urban land part. | | | | |
| Segno: | | | | |
| SeA, SeB | Fair: low strength. | Unsuited | Unsuited | Fair: thin layer. |

See footnotes at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Urban land: Ur. | | | | |
| Vamont: VaA, VaB | Poor: low strength, shrink-swell. | Unsuited | Unsuited | Poor: too clayey. |
| [1]Vn: Vamont part | Poor: low strength, shrink-swell. | Unsuited | Unsuited | Poor: too clayey. |
| Urban land part. | | | | |
| Voss: Vo, [1]Vs | Good | Good | Unsuited | Poor: too sandy. |
| Wockley: Wo | Fair: wetness. | Unsuited | Unsuited | Good. |
| [1]Wy: Wockley part | Fair: wetness. | Unsuited | Unsuited | Good. |
| Urban land part. | | | | |

[1]This mapping unit is made up of two or more dominant soils. See mapping unit description for the composition and behavior of the soils.

TABLE 12.--WATER MANAGEMENT

[No interpretations made for Urban land, properties are too variable. "Seepage" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe."]

| Soil name and map symbol | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| Addicks: | | | | | | |
| Ad | Moderate: seepage. | Moderate: low strength. | Favorable | Wetness | Wetness | Wetness. |
| [1]Ak: | | | | | | |
| Addicks part | Moderate: seepage. | Moderate: low strength. | Favorable | Wetness | Wetness | Wetness. |
| Urban land part. | | | | | | |
| Aldine: | | | | | | |
| Am | Slight | Moderate: unstable fill, low strength. | Percs slowly | Wetness, percs slowly. | Wetness, percs slowly. | Wetness. |
| [1]An: | | | | | | |
| Aldine part | Slight | Moderate: unstable fill, low strength. | Percs slowly | Wetness, percs slowly. | Wetness, percs slowly. | Wetness. |
| Urban land part. | | | | | | |
| Aris: | | | | | | |
| Ap | Slight | Moderate: low strength, compressible. | Wetness, percs slowly. | Wetness, percs slowly. | Wetness, percs slowly. | Wetness, percs slowly. |
| [1]Ar: | | | | | | |
| Aris part | Slight | Moderate: low strength, compressible. | Wetness, percs slowly. | Wetness, percs slowly. | Wetness, percs slowly. | Wetness, percs slowly. |
| Gessner part | Slight | Moderate: unstable fill, piping. | Wetness | Wetness | Wetness | Wetness. |
| [1]As: | | | | | | |
| Aris part | Slight | Moderate: low strength, compressible. | Wetness, percs slowly. | Wetness, percs slowly. | Wetness, percs slowly. | Wetness, percs slowly. |
| Urban land part. | | | | | | |
| Atasco: | | | | | | |
| AtB | Slight | Moderate: low strength, unstable fill. | Percs slowly | Percs slowly, wetness. | Percs slowly, wetness. | Favorable. |
| Beaumont: | | | | | | |
| Ba | Slight | Moderate: unstable fill, low strength. | Wetness, percs slowly. | Wetness, slow intake. | Wetness, percs slowly. | Wetness, percs slowly. |
| [1]Be: | | | | | | |
| Beaumont part | Slight | Moderate: unstable fill, low strength. | Wetness, percs slowly. | Wetness, slow intake. | Wetness, percs slowly. | Wetness, percs slowly. |
| Urban land part. | | | | | | |
| Bernard: | | | | | | |
| Bd | Slight | Moderate: low strength, unstable fill. | Percs slowly | Slow intake | Percs slowly, wetness. | Percs slowly, wetness. |

See footnotes at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

| Soil name and map symbol | Limitations for-- Pond reservoir areas | Embankments, dikes, and levees | Features affecting-- Drainage | Irrigation | Terraces and diversions | Grassed waterways |
|---|---|---|---|---|---|---|
| Bernard: | | | | | | |
| [1]Be: | | | | | | |
| Bernard part | Slight | Moderate: low strength, unstable fill. | Percs slowly | Slow intake | Percs slowly, wetness. | Percs slowly, wetness. |
| Edna part | Slight | Moderate: unstable fill. | Percs slowly | Wetness, percs slowly, slow intake. | Wetness, percs slowly. | Wetness, percs slowly. |
| [1]Bg: | | | | | | |
| Bernard part | Slight | Moderate: low strength, unstable fill. | Percs slowly | Slow intake | Percs slowly, wetness. | Percs slowly, wetness. |
| Urban land part. | | | | | | |
| Bissonnet: | | | | | | |
| Bn | Slight | Moderate: low strength, compressible. | Percs slowly | Wetness, slow intake. | Wetness, percs slowly. | Wetness. |
| Boy: | | | | | | |
| Bo | Severe: seepage. | Moderate: unstable fill, piping. | Complex slope, cutbanks cave. | Complex slope, fast intake, wetness. | Complex slope, piping, wetness. | Favorable. |
| Clodine: | | | | | | |
| Cd | Slight | Moderate: piping, compressible. | Percs slowly | Wetness, percs slowly. | Wetness, percs slowly. | Wetness, percs slowly. |
| [1]Ce: | | | | | | |
| Clodine part | Slight | Moderate: piping, compressible. | Percs slowly | Wetness, percs slowly. | Wetness, percs slowly. | Wetness, percs slowly. |
| Urban land part. | | | | | | |
| Edna: | | | | | | |
| Ed | Slight | Moderate: unstable fill. | Percs slowly | Wetness, percs slowly, slow intake. | Wetness, percs slowly. | Wetness, percs slowly. |
| Gessner: | | | | | | |
| Ge, [1]Gs | Slight | Moderate: unstable fill, piping. | Wetness | Wetness | Wetness | Wetness. |
| [1]Gu: | | | | | | |
| Gessner part | Slight | Moderate: unstable fill, piping. | Wetness | Wetness | Wetness | Wetness. |
| Urban land part. | | | | | | |
| Harris: | | | | | | |
| Ha | Slight | Moderate: unstable fill, low strength. | Wetness, floods, percs slowly. | Wetness, excess salt, floods. | Wetness, floods, excess salt. | Floods, excess salt. |
| Hatliff: | | | | | | |
| Hf | Severe: seepage. | Severe: seepage, unstable fill. | Floods, cutbanks cave. | Floods, wetness, seepage. | Wetness, piping. | Wetness. |
| Hockley: | | | | | | |
| HoA, HoB | Moderate: seepage. | Moderate: unstable fill. | Favorable | Favorable | Favorable | Favorable. |

See footnotes at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

| Soil name and map symbol | Limitations for-- Pond reservoir areas | Embankments, dikes, and levees | Features affecting-- Drainage | Irrigation | Terraces and diversions | Grassed waterways |
|---|---|---|---|---|---|---|
| Ijam: | | | | | | |
| [1]Is | Slight | Moderate: unstable fill, low strength. | Wetness, percs slowly, excess salt. | Wetness, percs slowly, excess salt. | Percs slowly, wetness. | Wetness, percs slowly, excess salt. |
| Kaman: | | | | | | |
| Ka | Slight | Moderate: low strength. | Floods | Slow intake, wetness, floods. | Floods, wetness, percs slowly. | Floods, wetness, percs slowly. |
| Katy: | | | | | | |
| Kf | Slight | Moderate: unstable fill. | Percs slowly | Percs slowly, wetness. | Wetness, percs slowly. | Wetness, percs slowly. |
| Kenney: | | | | | | |
| Kn | Severe: seepage. | Severe: seepage. | Cutbanks cave | Droughty, fast intake, seepage. | Too sandy, piping, erodes easily. | Droughty, erodes easily. |
| [1]Ku: | | | | | | |
| Kenney part | Severe: seepage. | Severe: seepage. | Cutbanks cave | Droughty, fast intake, seepage. | Too sandy, piping, erodes easily. | Droughty, erodes easily. |
| Urban land part. | | | | | | |
| Lake Charles: | | | | | | |
| LcA, LcB | Slight | Moderate: unstable fill, low strength. | Wetness, percs slowly. | Slow intake, wetness. | Wetness, percs slowly. | Wetness, percs slowly. |
| [1]Lu: | | | | | | |
| Lake Charles part | Slight | Moderate: unstable fill, low strength. | Wetness, percs slowly. | Slow intake, wetness. | Wetness, percs slowly. | Wetness, percs slowly. |
| Urban land part. | | | | | | |
| Midland: | | | | | | |
| Md | Slight | Moderate: compressible, low strength. | Percs slowly | Slow intake, wetness, percs slowly. | Not needed | Favorable. |
| [1]Mu: | | | | | | |
| Midland part | Slight | Moderate: compressible, low strength. | Percs slowly | Slow intake, wetness, percs slowly. | Not needed | Favorable. |
| Urban land part. | | | | | | |
| Nahatche: | | | | | | |
| Na | Moderate: seepage. | Moderate: unstable fill. | Floods, wetness. | Floods, wetness. | Floods, wetness. | Floods, wetness. |
| Ozan: | | | | | | |
| Oa | Slight | Moderate: unstable fill, piping, compressible. | Wetness, no water. | Wetness, percs slowly. | Wetness | Wetness. |
| [1]Om: | | | | | | |
| Ozan part | Slight | Moderate: unstable fill, piping, compressible. | Wetness, percs slowly. | Wetness | Wetness | Wetness. |
| Urban land part. | | | | | | |

See footnotes at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

| Soil name and map symbol | Limitations for-- Pond reservoir areas | Embankments, dikes, and levees | Features affecting-- Drainage | Irrigation | Terraces and diversions | Grassed waterways |
|---|---|---|---|---|---|---|
| Segno: SeA, SeB | Moderate: seepage. | Moderate: piping. | Favorable | Favorable | Favorable | Favorable. |
| Urban land: Ur. | | | | | | |
| Vamont: VaA, VaB | Slight | Moderate: unstable fill, low strength. | Percs slowly | Slow intake, wetness, percs slowly. | Wetness, percs slowly. | Percs slowly, wetness. |
| [1]Vn: Vamont part | Slight | Moderate: unstable fill, low strength. | Percs slowly | Slow intake, wetness, percs slowly. | Wetness, percs slowly. | Percs slowly, wetness. |
| Urban land part. | | | | | | |
| Voss: Vo, [1]Vs | Severe: seepage. | Severe: compressible, seepage, piping. | Floods, cutbanks cave. | Fast intake, seepage, wetness. | Piping, wetness, too sandy. | Wetness, erodes easily. |
| Wockley: Wo | Moderate: seepage. | Moderate: low strength, compressible. | Favorable | Wetness, percs slowly. | Wetness, percs slowly. | Wetness, percs slowly. |
| [1]Wy: Wockley part | Moderate: seepage. | Moderate: low strength, compressible. | Favorable | Wetness, percs slowly. | Wetness, percs slowly. | Wetness, percs slowly. |
| Urban land part. | | | | | | |

[1]This mapping unit is made up of two or more dominant soils. See mapping unit description for the composition and behavior of the soils.

TABLE 13.--ELECTRICAL RESISTIVITY AND CORROSION POTENTIAL OF SELECTED SOILS

| Soil name | Depth | Electrical resistivity | Corrosion potential for uncoated steel |
|---|---|---|---|
| | Feet | Ohms/cm$^3$ | |
| Addicks loam (Three profiles) | 0-3 | 1,400-2,000 | High. |
| | 3-6 | 1,100-1,600 | High. |
| | 6-9 | 700-1,200 | High. |
| | 9-12 | 900-1,900 | High. |
| | 12-15 | 1,000-1,600 | High. |
| | 15-18 | 700-2,700 | High to moderate. |
| Aldine very fine sandy loam. (One profile) | 0-3 | 2,200 | Moderate.[1] |
| | 3-6 | 1,000 | High. |
| | 6-9 | 900 | High. |
| | 9-12 | 1,400 | High. |
| | 12-15 | 1,900 | High. |
| | 15-18 | ----- | ---------- |
| Aris fine sandy loam (One profile) | 0-3 | 2,400 | Moderate.[1] |
| | 3-6 | 1,300 | High. |
| | 6-9 | 700 | High. |
| | 9-12 | 600 | High. |
| | 12-15 | 700 | High. |
| | 15-18 | 900 | High. |
| Beaumont clay (Three profiles) | 0-3 | 500-1,400 | High. |
| | 3-6 | 600-900 | High. |
| | 6-9 | 300-1,000 | High. |
| | 9-12 | 200-600 | High. |
| | 12-15 | 300-700 | High. |
| | 15-18 | 600 | High. |
| Bernard clay loam (Three profiles) | 0-3 | 700-1,500 | High. |
| | 3-6 | 600-900 | High. |
| | 6-9 | 800-1,100 | High. |
| | 9-12 | 500-1,900 | High. |
| | 12-15 | 400-2,100 | High to moderate. |
| | 15-18 | 300-1,600 | High. |
| Boy loamy fine sand (Two profiles) | 0-3 | 155,000-452,000 | Low. |
| | 3-6 | 172,100-359,000 | Low. |
| | 6-9 | 73,300-287,000 | Low. |
| | 9-12 | 56,300-125,300 | Low. |
| | 12-15 | 50,000-73,700 | Low. |
| | 15-18 | 44,200-53,700 | Low. |
| Clodine loam (One profile) | 0-3 | 2,400 | Moderate.[1] |
| | 3-6 | 1,500 | High. |
| | 6-9 | 1,100 | High. |
| | 9-12 | 900 | High. |
| | 12-15 | 800 | High. |
| | 15-18 | 900 | High. |
| Edna fine sandy loam (Two profiles) | 0-3 | 900-1,200 | High. |
| | 3-6 | 500-1,800 | High. |
| | 6-9 | 700-1,600 | High. |
| | 9-12 | 1,000-3,800 | High to moderate. |
| | 12-15 | 1,900-2,900 | High to moderate. |
| | 15-18 | 1,600-3,800 | High to moderate. |
| Gessner loam (Two profiles) | 0-3 | 2,400-6,500 | Moderate to low.[1] |
| | 3-6 | 1,400-1,600 | High. |
| | 6-9 | 2,700-2,900 | Moderate. |
| | 9-12 | 6,700-9,600 | Low. |
| | 12-15 | 4,000-8,800 | Moderate to low. |
| | 15-18 | 2,800-15,500 | Moderate to low. |

See footnote at end of table.

TABLE 13.--ELECTRICAL RESISTIVITY AND CORROSION POTENTIAL OF SELECTED SOILS--Continued

| Soil name | Depth | Electrical resistivity | Corrosion potential for uncoated steel |
|---|---|---|---|
| | Feet | $Ohms/cm^3$ | |
| Hockley fine sandy loam---- (One profile) | 0-3 | 91,200 | Low. |
| | 3-6 | 16,100 | Low.[1] |
| | 6-9 | 10,700 | Low.[1] |
| | 9-12 | 11,800 | Low. |
| | 12-15 | 5,500 | Low. |
| | 15-18 | 14,700 | Low. |
| Kaman clay---------------- (Two profiles) | 0-3 | 400-1,300 | High. |
| | 3-6 | 700-1,000 | High. |
| | 6-9 | 1,600-2,700 | High to moderate. |
| | 9-12 | 2,300-3,600 | Moderate. |
| | 12-15 | 1,800-4,400 | High to moderate. |
| | 15-18 | 2,700-3,400 | Moderate. |
| Katy fine sandy loam------- (One profile) | 0-3 | 12,000 | Low.[1] |
| | 3-6 | 1,600 | High. |
| | 6-9 | 700 | High. |
| | 9-12 | 1,000 | High. |
| | 12-15 | 2,900 | Moderate. |
| | 15-18 | 3,800 | Moderate. |
| Kenney loamy fine sand----- (Two profiles) | 0-3 | 79,800-410,000 | Low |
| | 3-6 | 48,700-260,500 | Low. |
| | 6-9 | 9,400-179,500 | Low. |
| | 9-12 | 9,600-104,400 | Low. |
| | 12-15 | 11,500-97,400 | Low. |
| | 15-18 | 23,000-73,600 | Low. |
| Lake Charles clay---------- (Four profiles) | 0-3 | 600-1,200 | High. |
| | 3-6 | 600-1,200 | High. |
| | 6-9 | 500-900 | High. |
| | 9-12 | 400-1,500 | High. |
| | 12-15 | 800-1,500 | High. |
| | 15-18 | 300-2,100 | High to moderate. |
| Midland silty clay loam---- (One profile) | 0-3 | 1,300 | High. |
| | 3-6 | 700 | High. |
| | 6-9 | 500 | High. |
| | 9-12 | 700 | High. |
| | 12-15 | 700 | High. |
| | 15-18 | 1,200 | High. |
| Ozan loam------------------ (Two profiles) | 0-3 | 3,300-3,400 | Moderate.[1] |
| | 3-6 | 1,100-1,500 | High. |
| | 6-9 | 1,000-1,600 | High. |
| | 9-12 | 1,900-2,400 | High to moderate. |
| | 12-15 | 900-1,900 | High. |
| | 15-18 | 1,400-2,900 | High to moderate. |
| Segno fine sandy loam------ (One profile) | 0-3 | 33,600 | Low. |
| | 3-6 | 12,200 | Low.[1] |
| | 6-9 | 8,700 | Low.[1] |
| | 9-12 | 9,600 | Low. |
| | 12-15 | 19,200 | Low. |
| | 15-18 | 8,800 | Low. |
| Vamont clay---------------- (Two profiles) | 0-3 | 1,100-1,600 | High |
| | 3-6 | 400-600 | High. |
| | 6-9 | 300-400 | High. |
| | 9-12 | 400 | High. |
| | 12-15 | 500 | High. |
| | 15-18 | 400-600 | High. |

See footnote at end of table.

TABLE 13.--ELECTRICAL RESISTIVITY AND CORROSION POTENTIAL OF SELECTED SOILS--Continued

| Soil name | Depth | Electrical resistivity | Corrosion potential for uncoated steel |
|---|---|---|---|
| | Feet | Ohms/cm$^3$ | |
| Voss sand------------------- (Two profiles) | 0-3 | 110,500-234,200 | Low. |
| | 3-6 | 174,200-324,200 | Low. |
| | 6-9 | 143,700-191,300 | Low. |
| | 9-12 | 95,800-132,100 | Low. |
| | 12-15 | 29,500-59,500 | Low. |
| | 15-18 | 28,800-44,100 | Low. |
| Wockley fine sandy loam---- (One profile) | 0-3 | 28,200 | Low.[1] |
| | 3-6 | 4,700 | Moderate.[1] |
| | 6-9 | 2,700 | Moderate. |
| | 9-12 | 3,000 | Moderate. |
| | 12-15 | 3,900 | Moderate. |
| | 15-18 | 3,700 | Moderate. |

[1]This layer has a slightly lower corrosion potential than that shown in table 17 for the same soil. Lower values probably can be attributed to moisture in the soil when measurements were made.

TABLE 14.--POTENTIAL OF THE SOILS FOR URBANIZATION

| Soil name and map symbol | Elements of urbanization | | | | Potential for urbanization | Major problems |
|---|---|---|---|---|---|---|
| | Dwellings[1] | Streets | Shallow excavations | Uncoated steel pipe | | |
| Addicks: Ad, Ak[2] | Medium | Medium | High | Low | Medium | Wetness. |
| Aldine: Am, An[2] | Medium | Medium | Low | Low | Medium | Wetness, shrink-swell potential. |
| Aris: Ap, Ar[2], As[2] | Low | Low | Low | Low | Low | Wetness, shrink-swell potential. |
| Atasco: AtB | High | Medium | Medium | Low | Medium | Shrink-swell potential. |
| Beaumont: Ba, Bc | Low | Low | Low | Low | Low | Shrink-swell potential, wetness. |
| Bernard: Bd, Be[2], Bg[2] | Low | Low | Low | Low | Low | Shrink-swell potential, wetness. |
| Bissonnet: Bn | High | High | High | Medium | High | Wetness. |
| Boy: Bo | High | High | Medium | High | High | Wetness. |
| Clodine: Cd, Ce[2] | Low | Low | High | Low | Low | Wetness. |
| Edna: Ed | Low | Low | Low | Low | Low | Shrink-swell potential, wetness. |
| Gessner: Ge, Gs, Gu[2] | Very low | Very low | Very low | Low | Very low | Flooding. |
| Harris: Ha | Very low | Very low | Very low | Low | Very low | Flooding, shrink-swell potential, wetness. |
| Hatliff: Hf | Very low | Very low | Very low | High | Very low | Flooding. |
| Hockley: HoA, HoB | High | High | Very high | Medium | Very high | None. |
| Ijam: Is | Low | Low | Low | Low | Low | Wetness, shrink-swell potential. |
| Kaman: Ka | Very low | Very low | Very low | Low | Very low | Flooding, shrink-swell potential. |
| Katy: Kf | Medium | High | High | Low | Medium | Wetness. |
| Kenney: Kn, Ku[2] | Very high | Very high | Very high | High | Very high | None. |
| Lake Charles: LcA, LcB, Lu[2]. | Low | Low | Low | Low | Low | Shrink-swell potential. |
| Midland: Md, Mu[2] | Low | Low | Low | Low | Low | Shrink-swell potential. |
| Nahatche: Na | Very low | Very low | Very low | Low | Very low | Flooding. |
| Ozan: Ow, On | Very low | Very low | Very low | Low | Very low | Flooding. |
| Segno: SeA, SeB | Very high | Very high | Very high | Medium | Very high | None. |
| Vamont: VaA, VaB, Vn[2] | Low | Low | Low | Low | Low | Shrink-swell potential. |
| Voss: Vo, Vs | Very low | Very low | Very low | High | Very low | Flooding. |
| Wockley: Wo, Wy[2] | High | High | High | Low | High | Wetness. |

[1]Dwellings without a basement but with a public sewer system.

[2]This mapping unit is made up of two or more dominant soils. See mapping unit description for the composition and behavior of the soils.

TABLE 19.--ENGINEERING TEST DATA--Continued

| Soil name and location | Depth from surface | Shrinkage: Linear | Shrinkage: Limit[2] | Shrinkage: Ratio | Shrinkage: Volumetric | Mechanical analysis[1]: Percentage passing sieve-- No. 4 | No. 10 | No. 40 | No. 200 | Percentage smaller than-- 0.05 mm | 0.02 mm | 0.005 mm | 0.002 mm | Liquid limit[2] | Plasticity index | Classification: AASHTO[3] | Unified[4] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Depth | | | | | | | | | | | | | | | | |
| Boy loamy fine sand: From Humble, 8.0 miles east on FM 1960 to Atascocita Country Club, then 2.33 miles northwest on gravel road and 100 feet north in timber (modal). Texas report no. 1271L-196, 195, 197. | 0-5 | 0.3 | 19.5 | 1.62 | 0.8 | | 100 | 88 | 14 | 6 | 3 | 0 | 0 | 22 | 6 | A-2-4(0) | SM-SC |
| | 9-37 | 0.0 | 22.6 | 1.69 | 0.0 | | 100 | 87 | 6 | 1 | 0 | 0 | 0 | 22 | 6 | A-2-4(0) | SP-SM |
| | 56-75 | 5.6 | 18.8 | 1.75 | 16.2 | | 100 | 98 | 47 | 32 | 22 | 16 | 15 | 30 | 14 | A-6(4) | SC |
| Clodine loam: From Houston Intercontinental Airport, 2.8 miles south on JFK Blvd. to Greens Road, 0.38 mile east on Greens Road, then 0.53 mile north and 60 feet east in pasture (modal). Texas report no. 1271L-258, 259, 260. | 6-12 | 0.5 | 19.9 | 1.81 | 1.8 | 100 | 99 | 99 | 66 | 50 | 27 | 15 | 12 | 21 | 5 | A-4(7) | CL-ML |
| | 29-51 | 7.9 | 10.5 | 1.98 | 22.1 | 93 | 89 | 88 | 64 | 52 | 32 | 18 | 16 | 25 | 11 | A-6(6) | CL |
| | 51-72 | 6.6 | 11.2 | 1.99 | 18.6 | 97 | 96 | 95 | 71 | 55 | 42 | 22 | 19 | 23 | 9 | A-4(8) | CL |
| Gessner loam: From Houston, 19.0 miles north on Interstate Highway 45 to FM 1960, then 2.03 miles south on Interstate Highway 45 access road and 75 feet east in pasture (modal). Texas report no. 1271L-271, 272, 273. | 0-7 | 3.1 | 12.6 | 1.85 | 9.0 | | | 100 | 47 | 37 | 25 | 7 | 5 | 18 | 4 | A-4(3) | SM-SC |
| | 34-53 | 4.7 | 12.4 | 1.88 | 13.4 | 100 | 99 | 99 | 58 | 44 | 29 | 15 | 13 | 21 | 8 | A-4(5) | CL |
| | 53-84 | 5.8 | 14.8 | 1.79 | 16.7 | 99 | 99 | 98 | 52 | 39 | 23 | 12 | 11 | 26 | 14 | A-6(5) | CL |
| Harris clay: From Pasadena, 7.0 miles east on Texas Highway 225 to Texas Highway 134, 3.5 miles north on Texas Highway 134 to San Jacinto State Park, 0.5 mile east to San Jacinto Monument, then 1,000 feet north in tidal flat (modal). Texas report no. 1271L-312, 313, 314. | 4-11 | 22.5 | 10.6 | 2.09 | 53.5 | | | 100 | 93 | 80 | 66 | 48 | 44 | 66 | 42 | A-7-6(20) | CH |
| | 32-45 | 24.7 | 8.5 | 2.13 | 57.3 | 98 | 95 | 91 | 86 | 79 | 73 | 56 | 53 | 71 | 49 | A-7-6(20) | CH |
| | 45-64 | 25.4 | 7.4 | 2.03 | 58.7 | 100 | 99 | 95 | 91 | 86 | 79 | 64 | 63 | 77 | 54 | A-7-6(20) | CH |

See footnotes at end of table.

TABLE 15.--SELECTED PLANTS SUITABLE FOR SOILS OF HARRIS COUNTY

| Soil name and map symbol | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| Addicks: Ad, [1]Ak | Chrysanthemum, canna, dichondra, caladium, forget-me-not, marigold, bigleaf periwinkle, zinnia, | English ivy, Virginia creeper, morningglory, jessamine, peppervine, wisteria, Halls honeysuckle. | Mockorange, pyracantha, oleander, bridalwreath, waxmyrtle, arrowwood, evergreen, sumac, witchhazel. | American elm, eastern cottonwood, hackberry, loquat, mimosa, pecan, liveoak, redbud. |
| Aldine: An, [1]An | Forget-me-not, amaryllis, daylily, pansy, canna, coralbells, bigleaf periwinkle, zinnia. | Peppervine, jessamine, purple Japanese honeysuckle, English ivy, morningglory, Virginia creeper. | Bridalwreath, gardenia, hydrangea, arrowwood, oleander, mockorange, camellia, American holly. | Sweetbay, hackberry, American sycamore, oak, sweetgum, American elm, mimosa, redbud, pine. |
| Aris: Ap, [1]Ar, [1]As | Coralbells, caladium, agapanthus, amaryllis, daylily, canna, bigleaf periwinkle, moonseed. | English ivy, jessamine, morningglory, bignonia, wisteria, Halls honeysuckle. | Arrowwood, elderberry, bridalwreath, oleander, mockorange, witchhazel, waxmyrtle. | Eastern cottonwood, American elm, mimosa, hackberry, red maple, American sycamore, oak, redbud. |
| Atasco: AtB | Dwarf rosemary, dahlia, gladiolus, hollyhock, shasta daisy, sweetpea, Chinese star-jasmine, mother of thyme. | English ivy, jessamine, grape, moonflower, wisteria, Halls honeysuckle, bignonia, pandorea. | Azalea, beautyberry, cherry laurel, gardenia, crapemyrtle, dogwood, flowering crabapple, butterflybush. | Ash, hickory, sweetgum, black locust, mulberry, southern magnolia, pecan, black walnut, pine. |
| Beaumont: Ba, [1]Bc | Petunia, canna, pansy, snapdragon, caladium, shasta daisy, zinnia, gladiolus. | Bignonia, English ivy, Virginia creeper, grapel jessamine, morningglory, Halls honeysuckle, moonflower. | American holly, common persimmon, butterflybush, American elder, flowering crabapple, pyracantha. | Oak, mimosa, sweetgum, American elm, hackberry, American sycamore. |
| Bernard: Bd, [1]Be, [1]Bg | Chinese star-jasmine, coralbells, caladium, canna, pansy, zinnia, African marigold, petunia. | English ivy, bignonia, peppervine, Virginia creeper, morningglory, yellownet honeysuckle. | Pyracantha, witchhazel, bridalwreath, oleander, waxmyrtle, arrowwood, elderberry, mockorange. | Live oak, mimosa, redbud, American sycamore, loquat, mulberry, hackberry. |
| Bissonnet: Bn | Shasta daisy, caladium, hollyhock, coralbells, pansy, canna, dahlia, gladiolus. | Jessamine, wisteria, bignonia, grape, Halls honeysuckle, pandorea. | Gardenia, bridalwreath, arrowwood, hydrangea, common persimmon, oleander, camellia, American holly. | American sycamore, oak, sweetbay, red maple, American elm, mimosa, sweetgum, redbud, pine. |

See footnotes at end of table.

TABLE 15.--SELECTED PLANTS SUITABLE FOR SOILS OF HARRIS COUNTY--Continued

| Soil name and map symbol | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| Boy: | | | | |
| Bo | Memorial rose, petunia, sand strawberry, beach, wormwood, canna, pansy, Chinese starjasmine, caladium. | English ivy, jessamine, Virginia creeper, grape, bignonia, cypressvine, Halls honeysuckle. | Beautyberry, redbay, gardenia, bottlebrush, flowering crab-apple, hydrangea, camellia, common persimmon. | American elm, sweetgum, American sycamore, oak, hackberry, sweetbay, eastern cottonwood, pine. |
| Clodine: | | | | |
| Cd, [1]Ce | Zinnia, chrysanthemum, forget-me-not, dichondra, African marigold, canna, daylily, caladium. | Morningglory, wisteria, jessamine, pepper-vine, English ivy, Halls honeysuckle. | Pyracantha, arrowwood, bridal-wreath, oleander, elderberry, wax-mrytle, mock-orange. | American elm, mimosa, live oak, mulberry, American sycamore, hackberry, redbud. |
| Edna: | | | | |
| Ed | Caladium, coral-bells, forget-me-not, zinnia, African marigold, canna, bigleaf periwinkle, chrysanthemum. | English ivy, jessamine, morningglory, Halls honeysuckle, wisteria, pepper-vine. | Pyracantha, elder-berry, oleander, mockorange, witchhazel, wax-myrtle, evergreen sumac, bridal-wreath. | Live oak, hackberry, American elm, mimosa, black tupelo, redbud, loquat. |
| Gessner: | | | | |
| Ge, [1]Gs, [1]Gu | Canna, chrysanthemum, caladium, forget-me-not, marigold, peppervine, big-leaf periwinkle, zinnia. | Morningglory, wisteria, English ivy, purple Japanese honey-suckle, Virginia creeper, jessamine. | Pyracantha, arrowwood, bridal-wreath, oleander, elderberry, mockorange, ever-green sumac, witchhazel. | Black tupelo, redbud, red maple, live oak, American elm, mimosa, eastern cottonwood. |
| Harris: | | | | |
| [2]Ha. | | | | |
| Hatliff: | | | | |
| Hf | Caladium, agapanthus, dwarf rosemary, canna, Chinese star-jasmine, amaryllis, gladiolus, dahlia. | English ivy, bignonia, jessamine, moon-flower, wisteria, pandorea, Halls honeysuckle, grape. | Azalea, cherry laurel, crape-mrytle, dogwood, Barbados cherry, waxligustrum, huckleberry, Arizona cypress. | Southern magnolia, ash, bald cypress, hickory, weeping willow, pecan, eastern cottonwood, mulberry. |
| Hockley: | | | | |
| HoA, HoB | Snapdragon, gladiolus, shasta daisy, petunia, hollyhock, dahlia, Chinese star-jasmine, pansy. | Pandorea, moon-flower, fleece-flower, bignonia, English ivy, purple Japanese honeysuckle, Halls honeysuckle, wisteria. | Azalea, beauty-berry, crape-myrtle, gardenia, cherry laurel, dogwood, Arizona cypress, huckle-berry. | Southern magnolia, ash, hickory, black locust, mulberry, pecan, oak, chinaberry, pine. |
| Ijam: | | | | |
| [2]Is. | | | | |

See footnotes at end of table.

TABLE 15.--SELECTED PLANTS SUITABLE FOR SOILS OF HARRIS COUNTY--Continued

| Soil name and map symbol | Flower and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| Kanan: Ka | Coralbells, moneywart, chrysanthemum, zinnia, forget-me-not, canna, caladium, amaryllis. | Cypressvine, purple Japanese honeysuckle, moonflower, peppervine, Virginia creeper, morningglory. | Beautyberry, oleander, flowering crab-apple, pyracantha, waxmyrtle, bridal-wreath, mock-orange. | American beech, oak, bald cypress, red maple, eastern cottonwood, weeping willow, river birch, American elm. |
| Katy: Kf | Caladium, forget-me-not, canna, petunia, pansy, bigleaf periwinkle, daylily, dichondra. | Morningglory, wisteria, jessamine, English ivy, Halls honey-suckle, bignonia. | Gardenia, bridal-wreath, arrowwood, hydrangea, common persimmon, camellia, oleander, American holly. | Hackberry, sweetgum, American elm, mimosa, American sycamore, oak, sweetbay, redbud. |
| Kenney: Kn, [1]Ku | Gladiolus, sweetfern, shasta daisy, pansy, hollyhock, snap-dragon, dahlia, petunia. | Pandorea, English ivy, cypressvine, bignonia, wisteria, jessamine, Halls honey-suckle, grape. | Azalea, cherry laurel, beauty-berry, gardenia, dogwood, crape-myrtle, Arizona cypress, huckleberry. | Southern magnolia, oak, black locust, hickory, mulberry, pecan, ash, chinaberry, pine. |
| Lake Charles: LcA, LcB, [1]Lu | Dewberry, chrysanthemum, blackberry, petunia, Chinese starjasmine, African marigold, canna, zinnia. | English ivy, bignonia, morning-glory, grape, Halls honeysuckle, peppervine, Virginia creeper. | Pyracantha, bottlebrush, flowering crab-apple, butterfly-bush, evergreen sumac, waxmrytle. | Live oak, hackberry, American elm, mimosa redbud, loquat. |
| Midland: Md, [1]Mu | Caladium, forget-me-not, coral-bells, lilyturf, bigleaf periwinkle, amaryllis, daylily, canna. | Virginia creeper, grape, English ivy, bignonia, morningglory, jessamine, Halls honeysuckle. | Oleander, wax-myrtle, mock-orange, camellia, bridalwreath, common persimmon, American holly. | River birch, mimosa, black tupelo, sweetbay, hack-berry, red maple, oak, redbud. |
| Nahatche: Na | Chinese star-jasmine, caladium, forget-me-not, coralbells, gladiolus, chrysanthemum, daylily, canna. | Bignonia, moon-flower, English ivy, jessamine, Virginia creeper, grape, Halls honeysuckle, morningglory. | Beautyberry, gardenia, bottle-brush, camellia, butterflybush, American holly, common persimmon, hydrangea. | American beech, oak, eastern cottonwood, weeping willow, sweetgum, southern magnolia, American sycamore, bald cypress. |
| Ozan: Oa, [1]On | Amaryllis, lily-turf, moonseed, coralbells, agapanthus, caladium, sweet woodruff, canna. | Morningglory, purple Japanese honeysuckle, English ivy, Virginia creeper, cypressvine, moonflower. | Gardenia, bridalwreath, arrowwood, hydrangea, camellia, oleander, common persimmon, American holly. | Bald cypress, sweetbay, eastern cottonwood, red maple, hackberry, American sycamore. American elm, sweetgum. |

See footnotes at end of table.

TABLE 15.--SELECTED PLANTS SUITABLE FOR SOILS OF HARRIS COUNTY--Continued

| Soil name and map symbol | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| Segno: SeA, SeB | Snapdragon, petunia, shasta daisy, gladiolus, hollyhock, pansy, Chinese star-jasmine, dahlia. | Pandorea, English ivy, wisteria, moonflower, purple Japanese honey-suckle, wisteria. | Azalea, huckle-berry, beauty-berry, gardenia, cherry laurel, dogwood, Arizona cypress, crapemyrtle. | Ash, southern magnolia, hickory, chinaberry, pecan, black locust, American sycamore, mulberry, pine. |
| Urban land: [2]Ur. | | | | |
| Vamont: VaA, VaB, [1]Vn. | Snapdragon, gladiolus, shasta daisy, caladium petunia, zinnia, canna, Chinese starjasmine. | Bignonia, morning-glory, pepper-vine, moonflower, English ivy, grape, cypressvine. | Flowering crab-apple, bottle-brush, camellia, butterflybush, American holly, American elder, common persimmon. | American sycamore, oak, sweetgum, hackberry, American elm, mimosa. |
| Voss: Vo, [1]Vs | Shasta daisy, dahlia, gladiolus, hollyhock, sweet-pea, snapdragon, sand strawberry, beach wormwood. | Fleeceflower, wisteria, pandorea, English ivy, kudzu, purple Japanese, honeysuckle, jessamine, grape. | Azalea, cherry laurel, crape-myrtle, dogwood, silverbell, Arizona cypress, huckleberry, waxligustrum. | Ash, American beech, eastern cottonwood, bald cypress, hickory, weeping willow, pecan, southern magnolia. |
| Wockley: Wo, [1]Wy | Coralbells, caladium, forget-me-not, daylily, bigleaf periwinkle, sweet woodruff, canna, pansy. | Wisteria, pepper-vine, yellownet honeysuckle, jessamine, English ivy. | Gardenia, mock-orange, waxmyrtle, oleander, elder-berry, camellia, common persimmon, hydrangea. | American elm, redbud, hackberry, red maple, American sycamore, oak, sweetgum, sweetbay, pine. |

[1]This mapping unit is made up of two or more dominant soils. See mapping unit description for the composition and behavior of the soils.
[2]Not rated.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

| Soil name and map symbol | Depth | USDA texture | Classification | | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | 4 | 10 | 40 | 200 | | |
| | In | | | | | | | | Pct | |
| Addicks: | | | | | | | | | | |
| Ad | 0-11 | Loam | CL, CL-ML | A-4, A-6 | 100 | 95-100 | 95-100 | 51-75 | 20-30 | 5-14 |
| | 11-49 | Loam, silt loam | CL, CL-ML | A-4, A-6 | 95-100 | 90-100 | 75-95 | 60-75 | 20-40 | 5-20 |
| | 49-78 | Loam, silt loam, silty clay loam. | CL | A-6, A-7 | 95-100 | 90-100 | 90-100 | 60-80 | 25-45 | 11-27 |
| [1]Ak: | | | | | | | | | | |
| Addicks part | 0-11 | Loam | CL, CL-ML | A-4, A-6 | 100 | 95-100 | 95-100 | 51-75 | 20-30 | 5-14 |
| | 11-49 | Loam, silt loam | CL, CL-ML | A-4, A-6 | 95-100 | 90-100 | 75-95 | 60-75 | 20-40 | 5-20 |
| | 49-78 | Loam, silt loam, silty clay loam. | CL | A-6, A-7 | 95-100 | 90-100 | 90-100 | 60-80 | 25-45 | 11-27 |
| Urban land part. | | | | | | | | | | |
| Aldine: | | | | | | | | | | |
| Am | 0-10 | Very fine sandy loam. | ML, CL, CL-ML | A-4 | 98-100 | 98-100 | 95-100 | 70-90 | <30 | [2]NP-10 |
| | 10-19 | Very fine sandy loam, loam, sandy clay loam. | CL | A-6, A-4 | 98-100 | 98-100 | 95-100 | 75-95 | 25-40 | 8-20 |
| | 19-60 | Clay, silty clay, clay loam | CH, CL | A-7-6 | 98-100 | 98-100 | 98-100 | 75-100 | 41-60 | 19-35 |
| [1]An: | | | | | | | | | | |
| Aldine part | 0-10 | Very fine sandy loam. | ML, CL, CL-ML | A-4 | 98-100 | 98-100 | 95-100 | 70-90 | <30 | NP-10 |
| | 10-19 | Very fine sandy loam, loam, sandy clay loam. | CL | A-6, A-4 | 98-100 | 98-100 | 95-100 | 75-95 | 25-40 | 8-20 |
| | 19-60 | Clay, silty clay, clay loam. | CH, CL | A-7-6 | 98-100 | 98-100 | 98-100 | 75-100 | 41-60 | 19-35 |
| Urban land part. | | | | | | | | | | |
| Aris: | | | | | | | | | | |
| Ap | 0-21 | Fine sandy loam | ML, CL, SC, SM | A-4 | 98-100 | 95-100 | 95-100 | 40-60 | <25 | NP-9 |
| | 21-28 | Sandy clay loam, clay loam, silty clay loam. | CL | A-6, A-7 | 100 | 95-100 | 95-100 | 55-75 | 39-48 | 18-25 |
| | 28-60 | Clay, clay loam, silty clay loam. | CL, CH | A-7 | 100 | 95-100 | 95-100 | 60-80 | 42-62 | 21-36 |
| | 60-78 | Clay loam, silty clay loam. | CL, CH | A-7 | 100 | 95-100 | 95-100 | 60-80 | 41-60 | 20-35 |
| [1]Ar: | | | | | | | | | | |
| Aris part | 0-21 | Fine sandy loam | ML, CL, SC, SM | A-4 | 98-100 | 95-100 | 95-100 | 40-60 | <25 | NP-9 |
| | 21-28 | Sandy clay loam, clay loam, silty clay loam. | CL | A-6, A-7 | 100 | 95-100 | 95-100 | 55-75 | 39-48 | 18-25 |
| | 28-60 | Clay, clay loam, silty clay loam. | CL, CH | A-7 | 100 | 95-100 | 95-100 | 60-80 | 42-62 | 21-36 |
| | 60-78 | Clay loam, silty clay loam. | CL, CH | A-7 | 100 | 95-100 | 95-100 | 60-80 | 41-60 | 20-35 |
| Gessner part | 0-16 | Loam | CL-ML, CL, SC, SM-SC | A-4 | 98-100 | 95-100 | 85-95 | 45-75 | 17-28 | 4-10 |
| | 16-80 | Loam, fine sandy loam. | CL-ML, CL | A-4, A-6 | 98-100 | 95-100 | 85-95 | 51-70 | 20-40 | 5-20 |

See footnotes at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

| Soil name and map symbol | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Percentage passing sieve number--: 4 | 10 | 40 | 200 | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | | | | | Pct | |
| Aris: | | | | | | | | | | |
| [1]As: | | | | | | | | | | |
| Aris part | 0-21 | Fine sandy loam | ML, CL, SC, SM | A-4 | 98-100 | 95-100 | 95-100 | 40-60 | <25 | NP-9 |
| | 21-28 | Sandy clay loam, clay loam, silty clay loam. | CL | A-6, A-7 | 100 | 95-100 | 95-100 | 55-75 | 39-48 | 18-25 |
| | 28-60 | Clay, clay loam, silty clay loam. | CL, CH | A-7 | 100 | 95-100 | 95-100 | 60-80 | 42-62 | 21-36 |
| | 60-78 | Clay loam, silty clay loam. | CL, CH | A-7 | 100 | 95-100 | 95-100 | 60-80 | 41-60 | 20-35 |
| Urban land part. | | | | | | | | | | |
| Atasco: | | | | | | | | | | |
| AtB | 0-16 | Fine sandy loam | ML, CL, CL-ML | A-4 | 98-100 | 98-100 | 90-100 | 60-75 | <25 | NP-8 |
| | 16-19 | Sandy clay loam, clay loam, silty clay loam. | CL | A-4, A-6, A-7 | 98-100 | 98-100 | 90-100 | 80-95 | 25-50 | 8-25 |
| | 19-60 | Clay, clay loam, silty clay loam. | CH, CL | A-7-6 | 98-100 | 98-100 | 95-100 | 80-95 | 41-65 | 17-35 |
| Beaumont: | | | | | | | | | | |
| Ba | 0-21 | Clay | CH | A-7 | 100 | 85-100 | 65-75 | 60-70 | 55-65 | 35-45 |
| | 21-59 | Clay, silty clay | CH | A-7 | 100 | 90-100 | 70-80 | 65-75 | 60-80 | 35-60 |
| | 59-73 | Clay, silty clay | CH | A-7 | 100 | 90-100 | 75-90 | 70-90 | 75-90 | 55-65 |
| [1]Bc: | | | | | | | | | | |
| Beaumont part | 0-21 | Clay | CH | A-7 | 100 | 85-100 | 65-75 | 60-70 | 55-65 | 35-45 |
| | 21-59 | Clay, silty clay | CH | A-7 | 100 | 90-100 | 70-80 | 65-75 | 60-80 | 35-60 |
| | 59-73 | Clay, silty clay | CH | A-7 | 100 | 90-100 | 75-90 | 70-90 | 75-90 | 55-65 |
| Urban land part. | | | | | | | | | | |
| Bernard: | | | | | | | | | | |
| Bd | 0-6 | Clay loam | CL, ML | A-6, A-7 | 100 | 98-100 | 90-100 | 80-90 | 30-45 | 12-30 |
| | 6-34 | Clay, silty clay, clay loam. | CL, CH, MH | A-7 | 98-100 | 98-100 | 90-100 | 90-100 | 41-60 | 22-44 |
| | 34-65 | Silty clay, silty clay loam, clay loam, clay. | CL, CH, MH | A-6, A-7 | 100 | 93-100 | 90-100 | 75-90 | 40-60 | 25-45 |
| [1]Be: | | | | | | | | | | |
| Bernard part | 0-6 | Clay loam | CL, ML | A-6, A-7 | 100 | 98-100 | 90-100 | 80-90 | 30-45 | 12-30 |
| | 6-34 | Clay, silty clay, clay loam. | CL, CH, MH | A-7 | 98-100 | 98-100 | 90-100 | 90-100 | 41-60 | 22-44 |
| | 34-65 | Silty clay, silty clay loam, clay loam, clay. | CL, CH, MH | A-6, A-7 | 100 | 93-100 | 90-100 | 75-90 | 40-60 | 25-45 |
| Edna part | 0-10 | Fine sandy loam | CL-ML, SM-SC, CL, SC | A-4, A-6 | 100 | 100 | 90-100 | 45-60 | <30 | NP-13 |
| | 10-41 | Clay, clay loam | CH | A-7 | 100 | 98-100 | 90-100 | 60-80 | 50-72 | 28-46 |
| | 41-72 | Clay, clay loam, sandy clay loam | CL, CH | A-7 | 100 | 98-100 | 80-100 | 70-80 | 41-60 | 20-36 |

See footnotes at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | 4 | 10 | 40 | 200 | | |
| | In | | | | | | | | Pct | |
| Bernard: | | | | | | | | | | |
| [1]Bg: | | | | | | | | | | |
| Bernard part----- | 0-6 | Clay loam------- | CL, ML | A-6, A-7 | 100 | 98-100 | 90-100 | 80-90 | 30-45 | 12-30 |
| | 6-34 | Clay, silty clay, clay loam. | CL, CH, MH | A-7 | 98-100 | 98-100 | 90-100 | 90-100 | 41-60 | 22-44 |
| | 34-65 | Silty clay, silty clay loam, clay loam, clay. | CL, CH, MH | A-6, A-7 | 100 | 93-100 | 90-100 | 75-90 | 40-60 | 25-45 |
| Urban land part. | | | | | | | | | | |
| Bissonnet: | | | | | | | | | | |
| Bn---------------- | 0-28 | Very fine sandy loam. | ML, CL, CL-ML | A-4 | 98-100 | 95-100 | 90-100 | 70-95 | <25 | NP-10 |
| | 28-32 | Sandy clay loam, loam, silt loam. | CL | A-6, A-7 | 98-100 | 98-100 | 90-100 | 75-95 | 30-45 | 11-20 |
| | 32-70 | Clay loam, sandy clay loam, silty clay loam. | CL, CH | A-6, A-7 | 98-100 | 98-100 | 95-100 | 75-95 | 35-55 | 15-30 |
| Boy: | | | | | | | | | | |
| Bo---------------- | 0-56 | Loamy fine sand, fine sand. | SM, SM-SC | A-2-4 | 100 | 100 | 85-100 | 14-35 | <25 | NP-7 |
| | 56-75 | Sandy loam, fine sandy loam, sandy clay loam. | CL, CL-ML, SC, SM-SC | A-4, A-6 | 100 | 90-100 | 80-100 | 36-55 | 23-40 | 6-20 |
| Clodine: | | | | | | | | | | |
| Cd---------------- | 0-12 | Loam------------ | CL-ML, CL | A-4, A-6 | 99-100 | 95-100 | 85-100 | 60-75 | 18-30 | 4-15 |
| | 12-29 | Loam, fine sandy loam. | CL, ML, CL-ML | A-6, A-4 | 90-100 | 88-100 | 80-90 | 60-75 | 25-40 | 5-20 |
| | 29-72 | Loam, fine sandy loam. | CL-ML, CL | A-6, A-4 | 90-100 | 88-100 | 85-95 | 60-80 | 20-40 | 5-20 |
| [1]Ce: | | | | | | | | | | |
| Clodine part----- | 0-12 | Loam------------ | CL-ML, CL | A-4, A-6 | 99-100 | 95-100 | 85-100 | 60-75 | 18-30 | 4-15 |
| | 12-29 | Loam, fine sandy loam. | CL, ML, CL-ML | A-6, A-4 | 90-100 | 88-100 | 80-90 | 60-75 | 25-40 | 5-20 |
| | 29-72 | Loam, fine sandy loam. | CL-ML, CL | A-6, A-4 | 90-100 | 88-100 | 85-95 | 60-80 | 20-40 | 5-20 |
| Urban land part. | | | | | | | | | | |
| Edna: | | | | | | | | | | |
| Ed---------------- | 0-5 | Fine sandy loam | CL-ML, SM-SC, CL, SC | A-4, A-6 | 100 | 100 | 90-100 | 45-60 | <30 | NP-13 |
| | 5-41 | Clay, clay loam | CH | A-7 | 100 | 98-100 | 90-100 | 60-80 | 51-72 | 28-46 |
| | 41-72 | Clay, clay loam, sandy clay loam | CL, CH | A-7 | 100 | 98-100 | 80-100 | 70-80 | 41-60 | 20-36 |
| Gessner: | | | | | | | | | | |
| Ge, [1]Gs----------- | 0-16 | Loam------------ | CL-ML, CL, SC, SM-SC | A-4 | 98-100 | 95-100 | 85-95 | 45-75 | 17-28 | 4-10 |
| | 16-80 | Loam, fine sandy loam. | CL-ML, CL | A-4, A-6 | 98-100 | 95-100 | 85-95 | 51-70 | 20-40 | 5-20 |
| [1]Gu: | | | | | | | | | | |
| Gessner part----- | 0-16 | Loam------------ | CL-ML, CL, SC, SM-SC | A-4 | 98-100 | 95-100 | 85-95 | 45-75 | 17-28 | 4-10 |
| | 16-80 | Loam, fine sandy loam. | CL-ML, CL | A-4, A-6 | 98-100 | 95-100 | 85-95 | 51-70 | 20-40 | 5-20 |
| Urban land part. | | | | | | | | | | |

See footnotes at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | 4 | 10 | 40 | 200 | | |
| | In | | | | | | | | Pct | |
| Harris: | | | | | | | | | | |
| Ha | 0-20 | Clay | CH | A-7 | 98-100 | 85-95 | 70-95 | 70-95 | 65-80 | 40-55 |
| | 20-45 | Clay, silty clay | CH | A-7 | 98-100 | 94-100 | 90-100 | 80-90 | 60-75 | 40-55 |
| | 45-64 | Silty clay, clay | CH | A-7 | 98-100 | 98-100 | 90-100 | 85-95 | 60-78 | 40-55 |
| Hatliff: | | | | | | | | | | |
| Hf | 0-10 | Loam, fine sandy loam. | SM-SC, CL, CL-ML, SC | A-4 | 100 | 95-100 | 65-95 | 40-75 | 20-30 | 4-9 |
| | 10-80 | Stratified fine sandy loam to sand. | SP-SM, SM, SC, SM-SC | A-2-4, A-4 | 100 | 95-100 | 50-90 | 5-45 | <30 | NP-9 |
| Hockley: | | | | | | | | | | |
| HoA, HoB | 0-23 | Fine sandy loam | CL-ML, CL, SC, SM-SC | A-4 | 98-100 | 98-100 | 95-100 | 40-80 | 18-30 | 4-10 |
| | 23-50 | Sandy clay loam, clay loam, loam. | CL | A-6, A-7, A-4 | 90-100 | 90-100 | 75-95 | 55-80 | 20-42 | 8-25 |
| | 50-80 | Sandy clay loam, clay loam, loam. | CL, SC | A-4, A-6, A-7 | 70-95 | 60-90 | 55-90 | 36-70 | 20-42 | 8-25 |
| Ijam: | | | | | | | | | | |
| [1]Is | 0-8 | Clay | CH, CL | A-7 | 98-100 | 90-100 | 90-99 | 70-95 | 45-80 | 25-55 |
| | 8-60 | Clay | CH | A-7 | 100 | 90-100 | 90-100 | 80-98 | 60-80 | 35-60 |
| Kaman: | | | | | | | | | | |
| Ka | 0-70 | Clay | CH, CL | A-7 | 98-100 | 98-100 | 90-100 | 75-90 | 46-66 | 24-42 |
| Katy: | | | | | | | | | | |
| Kf | 0-28 | Fine sandy loam | ML, SM | A-4 | 100 | 98-100 | 98-100 | 38-52 | <22 | NP-3 |
| | 28-65 | Clay loam, sandy clay loam. | CL | A-6, A-7 | 100 | 98-100 | 98-100 | 55-75 | 35-48 | 18-30 |
| Kenney: | | | | | | | | | | |
| Kn | 0-56 | Loamy fine sand | SM, SP-SM | A-2-4 | 100 | 99-100 | 75-100 | 10-30 | <22 | NP-3 |
| | 56-80 | Fine sandy loam, sandy clay loam, clay loam. | SC, CL, CL-ML, SM-SC | A-4, A-6, A-2-4, A-2-6 | 100 | 95-100 | 80-100 | 30-55 | 25-40 | 7-20 |
| [1]Ku: | | | | | | | | | | |
| Kenney part | 0-56 | Loamy fine sand | SM, SP-SM | A-2-4 | 100 | 99-100 | 75-100 | 10-30 | <22 | NP-3 |
| | 56-80 | Fine sandy loam, sandy clay loam, clay loam. | SC, CL, CL-ML, SM-SC | A-4, A-6, A-2-4, A-2-6 | 100 | 95-100 | 80-100 | 30-55 | 25-40 | 7-20 |
| Urban land part. | | | | | | | | | | |
| Lake Charles: | | | | | | | | | | |
| LcA, LcB | 0-22 | Clay | CH | A-7 | 100 | 99-100 | 80-100 | 75-100 | 64-80 | 40-55 |
| | 22-74 | Clay | CH | A-7 | 98-100 | 98-100 | 80-100 | 75-100 | 54-90 | 37-60 |
| [1]Lu: | | | | | | | | | | |
| Lake Charles part | 0-22 | Clay | CH | A-7 | 100 | 99-100 | 80-100 | 75-100 | 64-80 | 40-55 |
| | 22-74 | Clay | CH | A-7 | 98-100 | 98-100 | 80-100 | 75-100 | 54-90 | 37-60 |
| Urban land part. | | | | | | | | | | |
| Midland: | | | | | | | | | | |
| Md | 0-7 | Silty clay loam | CL | A-6 | 100 | 100 | 100 | 95-100 | 30-40 | 12-20 |
| | 7-72 | Silty clay, clay, silty clay loam. | CH, CL | A-7-6 | 100 | 100 | 100 | 95-100 | 40-65 | 20-40 |
| [1]Mu: | | | | | | | | | | |
| Midland part | 0-7 | Silty clay loam | CL | A-6 | 100 | 100 | 100 | 95-100 | 30-40 | 12-20 |
| | 7-72 | Silty clay, clay, silty clay loam. | CH, CL | A-7-6 | 100 | 100 | 100 | 95-100 | 40-65 | 20-40 |

See footnotes at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | 4 | 10 | 40 | 200 | | |
| | In | | | | | | | | Pct | |
| Midland: Urban land part. | | | | | | | | | | |
| Nahatche: Na | 0-18 | Loam | CL | A-6, A-7 | 100 | 100 | 90-100 | 70-80 | 30-45 | 11-25 |
| | 18-30 | Loam, clay loam, silty clay loam. | CL | A-6, A-4 | 100 | 100 | 85-95 | 50-75 | 28-40 | 8-20 |
| | 30-60 | Stratified loam to silty clay loam. | CL | A-6, A-7 | 100 | 100 | 90-100 | 70-80 | 30-45 | 11-25 |
| Ozan: Oa | 0-18 | Loam | SM, ML | A-4 | 95-100 | 95-100 | 90-100 | 40-75 | <20 | NP-3 |
| | 18-65 | Loam, sandy loam, sandy clay loam. | ML, CL-ML, CL | A-4 | 95-100 | 95-100 | 90-100 | 51-80 | <30 | NP-10 |
| [1]On: Ozan part | 0-18 | Loam | SM, ML | A-4 | 95-100 | 95-100 | 90-100 | 40-75 | <20 | NP-3 |
| | 18-65 | Loam, sandy loam, sandy clay loam. | ML, CL-ML, CL | A-4 | 95-100 | 95-100 | 90-100 | 51-80 | <30 | NP-10 |
| Urban land part. | | | | | | | | | | |
| Segno: SeA, SeB | 0-13 | Fine sandy loam | SM, CL-ML, ML, SM-SC | A-4 | 95-100 | 95-100 | 85-100 | 36-55 | <25 | NP-7 |
| | 13-42 | Sandy clay loam, clay loam, fine sandy loam. | SC, CL | A-6, A-4 | 80-100 | 80-100 | 70-100 | 40-60 | 20-35 | 8-20 |
| | 42-75 | Sandy clay loam, clay loam. | SC, CL | A-6, A-4 | 80-100 | 80-100 | 70-100 | 40-60 | 22-40 | 8-26 |
| Urban land: Ur. | | | | | | | | | | |
| Vamont: VaA, VaB | 0-8 | Clay | CH | A-7 | 100 | 85-100 | 65-75 | 60-70 | 58-66 | 35-41 |
| | 8-70 | Clay, silty clay | CH | A-7 | 100 | 90-100 | 70-80 | 65-75 | 62-76 | 38-49 |
| | 70-80 | Clay, silty clay | CH | A-7 | 100 | 90-100 | 75-90 | 80-90 | 62-76 | 38-49 |
| [1]Vn: Vamont part | 0-8 | Clay | CH | A-7 | 100 | 85-100 | 65-75 | 60-70 | 58-66 | 35-41 |
| | 8-70 | Clay, silty clay | CH | A-7 | 100 | 90-100 | 70-80 | 65-75 | 62-76 | 38-49 |
| | 70-80 | Clay, silty clay | CH | A-7 | 100 | 90-100 | 75-90 | 80-90 | 62-76 | 38-49 |
| Urban land part. | | | | | | | | | | |
| Voss: Vo, [1]Vs | 0-70 | Sand | SM-SC, SP-SM, SW-SM, SM | A-3, A-2-4 | 98-100 | 95-100 | 65-85 | 5-20 | <25 | NP-7 |
| Wockley: Wo | 0-22 | Fine sandy loam | CL, CL-ML | A-4, A-6 | 95-100 | 95-100 | 95-100 | 55-65 | 18-35 | 4-15 |
| | 22-60 | Sandy clay loam, clay loam, loam. | CL | A-4, A-6 | 85-100 | 85-100 | 80-100 | 60-75 | 20-35 | 8-17 |
| [1]Wy: Wockley part | 0-22 | Fine sandy loam | CL, CL-ML | A-4, A-6 | 95-100 | 95-100 | 95-100 | 55-65 | 18-35 | 4-15 |
| | 22-60 | Sandy clay loam, clay loam, loam. | CL | A-4, A-6 | 85-100 | 85-100 | 80-100 | 60-75 | 20-35 | 8-17 |
| Urban land part. | | | | | | | | | | |

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

[2]NP means nonplastic.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

| Soil name and map symbol | Depth | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Risk of corrosion: Uncoated steel | Risk of corrosion: Concrete | Erosion factors: K | Erosion factors: T |
|---|---|---|---|---|---|---|---|---|---|
| | In | In/hr | In/in | pH | | | | | |
| Addicks: | | | | | | | | | |
| Ad | 0-11 | 0.6-2.0 | 0.15-0.24 | 6.1-8.4 | Low | High | Low | 0.32 | 5 |
| | 11-49 | 0.6-2.0 | 0.15-0.24 | 6.6-8.4 | Low | High | Low | 0.37 | |
| | 49-78 | 0.6-2.0 | 0.15-0.24 | 6.6-8.4 | Moderate | High | Low | 0.37 | |
| [1]Ak: | | | | | | | | | |
| Addicks part | 0-11 | 0.6-2.0 | 0.15-0.24 | 6.1-8.4 | Low | High | Low | 0.32 | 5 |
| | 11-49 | 0.6-2.0 | 0.15-0.24 | 6.6-8.4 | Low | High | Low | 0.37 | |
| | 49-78 | 0.6-2.0 | 0.15-0.24 | 6.6-8.4 | Moderate | High | Low | 0.37 | |
| Urban land part. | | | | | | | | | |
| Aldine: | | | | | | | | | |
| Am | 0-10 | 0.6-2.0 | 0.13-0.20 | 4.5-6.0 | Low | High | High | 0.43 | 5 |
| | 10-19 | 0.2-0.6 | 0.13-0.20 | 4.5-6.0 | Moderate | High | High | 0.43 | |
| | 19-60 | <0.06 | 0.15-0.20 | 4.5-6.5 | High | High | High | 0.32 | |
| [1]An: | | | | | | | | | |
| Aldine part | 0-10 | 0.6-2.0 | 0.13-0.20 | 4.5-6.0 | Low | High | High | 0.43 | 5 |
| | 10-19 | 0.2-0.6 | 0.13-0.20 | 4.5-6.0 | Moderate | High | High | 0.43 | |
| | 19-60 | <0.06 | 0.15-0.20 | 4.5-6.5 | High | High | High | 0.32 | |
| Urban land part. | | | | | | | | | |
| Aris: | | | | | | | | | |
| Ap | 0-21 | 0.6-2.0 | 0.11-0.15 | 5.6-7.3 | Low | High | Moderate | 0.37 | 5 |
| | 21-28 | 0.2-0.6 | 0.12-0.17 | 5.1-6.5 | Moderate | High | Moderate | 0.32 | |
| | 28-60 | <0.06 | 0.12-0.18 | 5.1-6.5 | High | High | Moderate | 0.32 | |
| | 60-78 | <0.06 | 0.12-0.18 | 5.1-7.3 | High | High | Moderate | 0.32 | |
| [1]Ar: | | | | | | | | | |
| Aris part | 0-21 | 0.6-2.0 | 0.11-0.15 | 5.6-7.3 | Low | High | Moderate | 0.37 | 5 |
| | 21-28 | 0.2-0.6 | 0.12-0.17 | 5.1-6.5 | Moderate | High | Moderate | 0.32 | |
| | 28-60 | <0.06 | 0.12-0.18 | 5.1-6.5 | High | High | Moderate | 0.32 | |
| | 60-78 | <0.06 | 0.12-0.18 | 5.1-7.3 | High | High | Moderate | 0.32 | |
| Gessner part | 0-16 | 0.6-2.0 | 0.10-0.15 | 5.1-7.8 | Low | High | Low | 0.43 | 5 |
| | 16-80 | 0.6-2.0 | 0.15-0.20 | 5.6-8.4 | Low | High | Low | 0.43 | |
| [1]As: | | | | | | | | | |
| Aris part | 0-21 | 0.6-2.0 | 0.11-0.15 | 5.6-7.3 | Low | High | Moderate | 0.37 | 5 |
| | 21-28 | 0.2-0.6 | 0.12-0.17 | 5.1-6.5 | Moderate | High | Moderate | 0.32 | |
| | 28-60 | <0.06 | 0.12-0.18 | 5.1-6.5 | High | High | Moderate | 0.32 | |
| | 60-78 | <0.06 | 0.12-0.18 | 5.1-7.3 | High | High | Moderate | 0.32 | |
| Urban land part. | | | | | | | | | |
| Atasco: | | | | | | | | | |
| AtB | 0-16 | 0.6-2.0 | 0.14-0.18 | 5.1-6.5 | Low | Low | Low | 0.37 | 5 |
| | 16-19 | 0.2-0.6 | 0.15-0.19 | 4.5-6.0 | Low | Moderate | Moderate | 0.37 | |
| | 19-60 | <0.06 | 0.15-0.22 | 4.5-6.0 | Moderate | High | Moderate | 0.32 | |
| Beaumont: | | | | | | | | | |
| Ba | 0-21 | 0.06-0.2 | 0.15-0.20 | 4.5-6.0 | High | High | Moderate | 0.32 | 5 |
| | 21-59 | <0.06 | 0.15-0.20 | 4.5-5.5 | High | High | Moderate | 0.32 | |
| | 59-73 | <0.06 | 0.15-0.20 | 5.1-7.8 | High | High | Moderate | 0.32 | |
| [1]Be: | | | | | | | | | |
| Beaumont part | 0-21 | 0.06-0.2 | 0.15-0.20 | 4.5-6.0 | High | High | Moderate | 0.32 | 5 |
| | 21-59 | <0.06 | 0.15-0.20 | 4.5-5.5 | High | High | Moderate | 0.32 | |
| | 59-73 | <0.06 | 0.15-0.20 | 5.1-7.8 | High | High | Moderate | 0.32 | |
| Urban land part. | | | | | | | | | |

See footnotes at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

| Soil name and map symbol | Depth | Permea-bility | Available water capacity | Soil reaction | Shrink-swell potential | Risk of corrosion: Uncoated steel | Risk of corrosion: Concrete | Erosion factors: K | Erosion factors: T |
|---|---|---|---|---|---|---|---|---|---|
| | In | In/hr | In/in | pH | | | | | |
| Bernard: | | | | | | | | | |
| Bd | 0-6 | 0.06-0.2 | 0.15-0.20 | 6.1-7.3 | Moderate | High | Low | 0.32 | 5 |
| | 6-34 | <0.06 | 0.12-0.18 | 6.1-7.8 | High | High | Low | 0.32 | |
| | 34-65 | <0.06 | 0.15-0.20 | 6.6-8.4 | High | High | Low | 0.32 | |
| [1]Be: | | | | | | | | | |
| Bernard part | 0-6 | 0.06-0.2 | 0.15-0.20 | 6.1-7.3 | Moderate | High | Low | 0.32 | 5 |
| | 6-34 | <0.06 | 0.12-0.18 | 6.1-7.8 | High | High | Low | 0.32 | |
| | 34-65 | <0.06 | 0.15-0.20 | 6.6-8.4 | High | High | Low | 0.32 | |
| Edna part | 0-10 | 0.6-2.0 | 0.10-0.15 | 5.6-7.3 | Low | High | Low | 0.43 | 5 |
| | 10-41 | <0.06 | 0.15-0.20 | 5.6-7.3 | High | High | Low | 0.37 | |
| | 41-72 | <0.06 | 0.15-0.20 | 6.6-8.4 | High | High | Low | 0.37 | |
| [1]Bg: | | | | | | | | | |
| Bernard part | 0-6 | 0.06-0.2 | 0.15-0.20 | 6.1-7.3 | Moderate | High | Low | 0.32 | 5 |
| | 6-34 | <0.06 | 0.12-0.18 | 6.1-7.8 | High | High | Low | 0.32 | |
| | 34-65 | <0.06 | 0.15-0.20 | 6.6-8.4 | High | High | Low | 0.32 | 5 |
| Urban land part. | | | | | | | | | |
| Bissonnet: | | | | | | | | | |
| Bn | 0-28 | 0.6-2.0 | 0.14-0.18 | 4.5-6.0 | Low | Low | Moderate | 0.43 | 5 |
| | 28-32 | 0.2-0.6 | 0.15-0.19 | 4.5-6.0 | Low | Moderate | Moderate | 0.43 | |
| | 32-70 | 0.06-0.2 | 0.16-0.22 | 4.5-7.8 | Moderate | Moderate | Moderate | 0.43 | |
| Boy: | | | | | | | | | |
| Bo | 0-56 | 6.0-20 | 0.05-0.10 | 4.5-6.5 | Low | Low | High | 0.17 | 5 |
| | 56-75 | 0.2-0.6 | 0.10-0.15 | 4.5-6.0 | Low | Low | High | 0.24 | |
| Clodine: | | | | | | | | | |
| Cd | 0-12 | 0.6-2.0 | 0.15-0.20 | 6.1-7.8 | Low | High | Low | 0.32 | 5 |
| | 12-29 | 0.6-2.0 | 0.15-0.20 | 6.1-8.4 | Moderate | High | Low | 0.32 | |
| | 29-72 | 0.6-2.0 | 0.12-0.20 | 6.6-8.4 | Moderate | High | Low | 0.32 | |
| [1]Ce: | | | | | | | | | |
| Clodine part | 0-12 | 0.6-2.0 | 0.15-0.20 | 6.1-7.8 | Low | High | Low | 0.32 | 5 |
| | 12-29 | 0.6-2.0 | 0.15-0.20 | 6.1-8.4 | Moderate | High | Low | 0.32 | |
| | 29-72 | 0.6-2.0 | 0.12-0.20 | 6.6-8.4 | Moderate | High | Low | 0.32 | |
| Urban land part. | | | | | | | | | |
| Edna: | | | | | | | | | |
| Ed | 0-5 | 0.6-2.0 | 0.10-0.15 | 5.6-7.3 | Low | High | Low | 0.43 | 5 |
| | 5-41 | <0.06 | 0.15-0.20 | 5.6-7.3 | High | High | Low | 0.37 | |
| | 41-72 | <0.06 | 0.15-0.20 | 6.6-8.4 | High | High | Low | 0.37 | |
| Gessner: | | | | | | | | | |
| Ge, [1]Gm | 0-16 | 0.6-2.0 | 0.10-0.15 | 6.1-7.8 | Low | High | Low | 0.43 | 5 |
| | 16-80 | 0.6-2.0 | 0.15-0.20 | 6.6-8.4 | Low | High | Low | 0.43 | |
| [1]Gu: | | | | | | | | | |
| Gessner part | 0-16 | 0.6-2.0 | 0.10-0.15 | 6.1-7.8 | Low | High | Low | 0.43 | 5 |
| | 16-80 | 0.6-2.0 | 0.15-0.20 | 6.6-8.4 | Low | High | Low | 0.43 | |
| Urban land part. | | | | | | | | | |
| Harris: | | | | | | | | | |
| Ha | 0-20 | 0.06-0.2 | 0.02-0.20 | 6.6-9.0 | High | High | High | 0.20 | 5 |
| | 20-45 | <0.06 | 0.01-0.10 | 6.6-9.0 | High | High | High | 0.32 | |
| | 45-64 | <0.06 | 0.01-0.10 | 6.6-9.0 | High | High | High | 0.32 | |
| Hatliff: | | | | | | | | | |
| Hf | 0-10 | 2.0-6.0 | 0.11-0.15 | 5.1-7.3 | Low | Low | Moderate | 0.24 | 5 |
| | 10-80 | 2.0-6.0 | 0.05-0.11 | 5.1-7.3 | Low | Low | Moderate | 0.24 | |
| Hockley: | | | | | | | | | |
| HoA, HoB | 0-23 | 2.0-6.0 | 0.10-0.15 | 5.1-6.5 | Low | Low | Low | 0.24 | 5 |
| | 23-50 | 0.6-2.0 | 0.12-0.17 | 5.1-6.5 | Moderate | Moderate | Low | 0.32 | |
| | 50-80 | 0.2-0.6 | 0.10-0.15 | 5.1-6.5 | Moderate | Moderate | Low | 0.28 | |

See footnotes at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

| Soil name and map symbol | Depth | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Risk of corrosion: Uncoated steel | Risk of corrosion: Concrete | Erosion factors: K | Erosion factors: T |
|---|---|---|---|---|---|---|---|---|---|
| | In | In/hr | In/in | pH | | | | | |
| Ijam: | | | | | | | | | |
| [1]Is | 0-8 | <0.06 | 0.10-0.12 | 6.6-9.0 | High | High | High | 0.32 | 5 |
| | 8-60 | <0.06 | 0.10-0.12 | 6.6-9.0 | High | High | High | 0.32 | |
| Kaman: | | | | | | | | | |
| Ka | 0-70 | <0.06 | 0.15-0.20 | 5.6-7.8 | High | High | Moderate | 0.32 | 5 |
| Katy: | | | | | | | | | |
| Kf | 0-28 | 0.6-2.0 | 0.15-0.20 | 5.6-6.5 | Low | Moderate | Moderate | 0.37 | 5 |
| | 28-65 | <0.2 | 0.12-0.18 | 5.1-7.3 | Moderate | High | Moderate | 0.32 | |
| Kenney: | | | | | | | | | |
| Kn | 0-56 | 6.0-20 | 0.06-0.10 | 5.1-6.5 | Low | Low | Moderate | 0.17 | 5 |
| | 56-80 | 2.0-6.0 | 0.11-0.15 | 5.1-6.5 | Low | Low | Moderate | 0.24 | |
| [1]Ku: | | | | | | | | | |
| Kenney part | 0-56 | 6.0-20 | 0.06-0.10 | 5.1-6.5 | Low | Low | Moderate | 0.17 | 5 |
| | 56-80 | 2.0-6.0 | 0.11-0.15 | 5.1-6.5 | Low | Low | Moderate | 0.24 | |
| Urban land part. | | | | | | | | | |
| Lake Charles: | | | | | | | | | |
| LcA, LcB | 0-22 | 0.06-0.2 | 0.15-0.20 | 6.1-7.8 | High | High | Low | 0.32 | 5 |
| | 22-74 | <0.06 | 0.15-0.20 | 6.6-8.4 | High | High | Low | 0.32 | |
| [1]Lu: | | | | | | | | | |
| Lake Charles part | 0-22 | 0.06-0.2 | 0.15-0.20 | 6.1-7.8 | High | High | Low | 0.32 | 5 |
| | 22-74 | <0.06 | 0.15-0.20 | 6.6-8.4 | High | High | Low | 0.32 | |
| Urban land part. | | | | | | | | | |
| Midland: | | | | | | | | | |
| Md | 0-7 | 0.06-0.2 | 0.20-0.22 | 5.1-6.5 | Moderate | High | Moderate | 0.37 | 5 |
| | 7-72 | <0.06 | 0.18-0.20 | 5.6-8.4 | High | High | Low | 0.32 | |
| [1]Mu: | | | | | | | | | |
| Midland part | 0-7 | 0.06-0.2 | 0.20-0.22 | 5.1-6.5 | Moderate | High | Moderate | 0.37 | 5 |
| | 7-72 | <0.06 | 0.18-0.20 | 5.6-8.4 | High | High | Low | 0.32 | |
| Urban land part. | | | | | | | | | |
| Nahatche: | | | | | | | | | |
| Na | 0-18 | 0.6-2.0 | 0.10-0.15 | 5.1-7.8 | Moderate | Moderate | Moderate | 0.28 | 5 |
| | 18-30 | 0.6-2.0 | 0.10-0.15 | 5.1-7.8 | Moderate | High | Moderate | 0.28 | |
| | 30-60 | 0.6-2.0 | 0.10-0.15 | 5.1-7.8 | Moderate | High | Moderate | 0.28 | |
| Ozan: | | | | | | | | | |
| Oa | 0-18 | 0.6-2.0 | 0.14-0.17 | 4.5-6.0 | Low | High | High | 0.37 | 5 |
| | 18-65 | 0.06-0.2 | 0.15-0.18 | 4.5-6.0 | Low | High | High | 0.37 | |
| [1]On: | | | | | | | | | |
| Ozan part | 0-18 | 0.6-2.0 | 0.14-0.17 | 4.5-6.0 | Low | High | High | 0.37 | 5 |
| | 18-65 | 0.06-0.2 | 0.15-0.18 | 4.5-6.0 | Low | High | High | 0.37 | |
| Urban land part. | | | | | | | | | |
| Segno: | | | | | | | | | |
| SeA, SeB | 0-13 | 0.6-2.0 | 0.10-0.15 | 5.1-6.5 | Low | Low | Moderate | 0.24 | 5 |
| | 13-42 | 0.2-0.6 | 0.10-0.15 | 4.5-6.0 | Low | Moderate | High | 0.32 | |
| | 42-75 | 0.2-0.6 | 0.08-0.12 | 4.5-6.0 | Low | Moderate | High | 0.24 | |
| Urban land: | | | | | | | | | |
| Ur. | | | | | | | | | |
| Vamont: | | | | | | | | | |
| VaA, VaB | 0-8 | 0.06-0.2 | 0.15-0.2 | 4.5-7.3 | High | High | Moderate | 0.32 | 5 |
| | 8-70 | <0.06 | 0.15-0.2 | 5.1-7.3 | High | High | Moderate | 0.32 | |
| | 70-80 | <0.06 | 0.15-0.2 | 5.6-7.8 | High | High | Moderate | 0.32 | |

See footnotes at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

| Soil name and map symbol | Depth | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Risk of corrosion | | Erosion factors | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Uncoated steel | Concrete | K | T |
| | In | In/hr | In/in | pH | | | | | |
| Vamont: | | | | | | | | | |
| [1]Vo: | | | | | | | | | |
| Vamont part------- | 0-8 | 0.06-0.2 | 0.15-0.2 | 4.5-7.3 | High------ | High---------- | Moderate------- | 0.32 | 5 |
| | 8-70 | <0.06 | 0.15-0.2 | 5.1-7.3 | High------ | High---------- | Moderate------- | 0.32 | |
| | 70-80 | <0.06 | 0.15-0.2 | 5.6-7.8 | High------ | High---------- | Moderate------- | 0.32 | |
| Urban land part. | | | | | | | | | |
| Voss: | | | | | | | | | |
| Vo, [1]Vs----------- | 0-70 | 6.0-20 | 0.02-0.06 | 5.6-7.3 | Low------- | Low----------- | Moderate------- | 0.17 | 5 |
| Wockley: | | | | | | | | | |
| Wo----------------- | 0-22 | 2.0-6.0 | 0.15-0.20 | 5.1-6.5 | Low------- | High---------- | Moderate------- | 0.24 | 5 |
| | 22-60 | 0.2-0.6 | 0.12-0.18 | 4.5-6.0 | Low------- | High---------- | Moderate------- | 0.32 | |
| [1]Wy: | | | | | | | | | |
| Wockley part----- | 0-22 | 2.0-6.0 | 0.15-0.20 | 5.1-6.5 | Low------- | High---------- | Moderate------- | 0.24 | 5 |
| | 22-60 | 0.2-0.6 | 0.12-0.18 | 4.5-6.0 | Low------- | High---------- | Moderate------- | 0.32 | |
| Urban land part. | | | | | | | | | |

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 18.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. The symbol < means less than; > means greater than]

| Soil name and map symbol | Hydro-logic group | Flooding | | | High water table | | |
|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months |
| | | | | | Ft | | |
| Addicks: | | | | | | | |
| Ad---------------- | D | None----------- | --- | --- | 1.0-2.5 | Apparent | Jan-Feb |
| [1]Ak: | | | | | | | |
| Addicks part----- | D | None----------- | --- | --- | 1.0-2.5 | Apparent | Jan-Feb |
| Urban land part. | | | | | | | |
| Aldine: | | | | | | | |
| Am---------------- | D | None----------- | --- | --- | 1.5-2.5 | Perched | Nov-May |
| [1]An: | | | | | | | |
| Aldine part------ | D | None----------- | --- | --- | 1.5-2.5 | Perched | Nov-May |
| Urban land part. | | | | | | | |
| Aris: | | | | | | | |
| Ap---------------- | D | None----------- | --- | --- | 0-2.0 | Perched | Nov-Mar |
| [1]Ar: | | | | | | | |
| Aris part-------- | D | None----------- | --- | --- | 0-2.0 | Perched | Nov-Mar |
| Gessner part----- | B/D | None----------- | --- | --- | 0-2.0 | Apparent | Nov-May |
| [1]As: | | | | | | | |
| Aris part-------- | D | None----------- | --- | --- | 0-2.0 | Perched | Nov-Mar |
| Urban land part. | | | | | | | |
| Atasco: | | | | | | | |
| AtB--------------- | C | None----------- | --- | --- | 1.5-2.5 | Perched | Nov-Feb |
| Beaumont: | | | | | | | |
| Ba---------------- | D | Rare----------- | --- | --- | 0-2.0 | Apparent | Nov-Mar |
| [1]Bc: | | | | | | | |
| Beaumont part---- | D | Rare----------- | --- | --- | 0-2.0 | Apparent | Nov-Mar |
| Urban land part. | | | | | | | |
| Bernard: | | | | | | | |
| Bd---------------- | D | None----------- | --- | --- | 0-3.0 | Apparent | Dec-Feb |
| [1]Be: | | | | | | | |
| Bernard part----- | D | None----------- | --- | --- | 0-3.0 | Apparent | Dec-Feb |
| Edna part-------- | D | None----------- | --- | --- | 0-1.5 | Perched | Dec-Mar |
| [1]Bg: | | | | | | | |
| Bernard part----- | D | None----------- | --- | --- | 0-3.0 | Apparent | Dec-Feb |
| Urban land part. | | | | | | | |
| Bissonnet: | | | | | | | |
| Bn---------------- | D | None----------- | --- | --- | 2.0-3.5 | Perched | Nov-Feb |
| Boy: | | | | | | | |
| Bo---------------- | B | None----------- | --- | --- | 3.5-5.5 | Perched | Nov-Feb |
| Clodine: | | | | | | | |
| Cd---------------- | D | None----------- | --- | --- | 0-2.5 | Apparent | Dec-Mar |
| [1]Ce: | | | | | | | |
| Clodine part----- | D | None----------- | --- | --- | 0-2.5 | Apparent | Dec-Mar |
| Urban land part. | | | | | | | |

See footnotes at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

| Soil name and map symbol | Hydro-logic group | Flooding | | | High water table | | |
|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months |
| | | | | | Ft | | |
| Edna: | | | | | | | |
| Ed | D | None | --- | --- | 0-1.5 | Perched | Dec-Mar |
| Gessner: | | | | | | | |
| Ge, [1]Gs | B/D | Common | Long | Sep-Jun | 0-2.0 | Apparent | Nov-May |
| [1]Gu: | | | | | | | |
| Gessner part | B/D | Common | Long | Sep-Jun | 0-2.0 | Apparent | Nov-May |
| Urban land part. | | | | | | | |
| Harris: | | | | | | | |
| Ha | D | Common | Long | Sep-Jun | 0-4.0 | Apparent | Sep-Jun |
| Hatliff: | | | | | | | |
| Hf | C | Frequent | Brief | Nov-May | 0-2.0 | Apparent | Nov-Mar |
| Hockley: | | | | | | | |
| HoA, HoB | C | None | --- | --- | 3.5-5.0 | Perched | Dec-Mar |
| Ijam: | | | | | | | |
| [1]Is | D | Rare | Very brief | Apr-Oct | 0-3.0 | Apparent | Sep-May |
| Kaman: | | | | | | | |
| Ka | D | Common | Long | Nov-Jun | 0-2.5 | Apparent | Sep-Jul |
| Katy: | | | | | | | |
| Kf | D | None | --- | --- | 0-2.5 | Perched | Dec-Jan |
| Kenney: | | | | | | | |
| Kn | A | None | --- | --- | >6.0 | --- | --- |
| [1]Ku: | | | | | | | |
| Kenney part | A | None | --- | --- | >6.0 | --- | --- |
| Urban land part. | | | | | | | |
| Lake Charles: | | | | | | | |
| LcA, LcB | D | None | --- | --- | 0-2.0 | Apparent | Dec-Feb |
| [1]Lu: | | | | | | | |
| Lake Charles part | D | None | --- | --- | 0-2.0 | Apparent | Dec-Feb |
| Urban land part. | | | | | | | |
| Midland: | | | | | | | |
| Md | D | None | --- | --- | 0.5-3.0 | Apparent | Dec-Apr |
| [1]Mu: | | | | | | | |
| Midland part | D | None | --- | --- | 0.5-3.0 | Apparent | Dec-Apr |
| Urban land part. | | | | | | | |
| Nahatche: | | | | | | | |
| Na | C | Frequent | Brief to long | Nov-May | 0-1.5 | Apparent | Nov-May |
| Ozan: | | | | | | | |
| Oa | D | Common | Long | Sep-Jun | 1.0-2.5 | Perched | Dec-May |
| [1]On: | | | | | | | |
| Ozan part | D | Common | Long | Sep-Jun | 1.0-2.5 | Perched | Dec-May |
| Urban land part. | | | | | | | |
| Segno: | | | | | | | |
| SeA, SeB | C | None | --- | --- | 2.0-3.0 | Perched | Dec-Apr |
| Urban land: | | | | | | | |
| Ur. | | | | | | | |

See footnotes at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

| Soil name and map symbol | Hydro-logic group | Flooding | | | High water table | | |
|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months |
| | | | | | Ft | | |
| Vamont: VaA, VaB | D | None | --- | --- | 0-2.0 | Apparent | Nov-Mar |
| [1]Vn: Vamont part | D | None | --- | --- | 0-2.0 | Apparent | Nov-Mar |
| Urban land part. | | | | | | | |
| Voss: Vo, [1]Vs | B | Frequent | Brief | Oct-Mar | 2.0-5.0 | Apparent | Oct-May |
| Wockley: Wo | C | None | --- | --- | 0-2.0 | Perched | Nov-Mar |
| [1]Wy: Wockley part | C | None | --- | --- | 0-2.0 | Perched | Nov-Mar |
| Urban land part. | | | | | | | |

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 19.--ENGINEERING TEST DATA

[Tests performed by the Texas Highway Department in accordance with standard procedures of the American Association of State Highway and Transportation Officials]

| Soil name and location | Depth from surface | Shrinkage: Linear | Shrinkage: Limit[2] | Shrinkage: Ratio | Shrinkage: Volumetric | Mechanical analysis[1]: Percentage passing sieve--No. 4 | No. 10 | No. 40 | No. 200 | Percentage smaller than--0.05 mm | 0.02 mm | 0.005 mm | 0.002 mm | Liquid limit[2] | Plasticity index | Classification: AASHTO[3] | Classification: Unified[4] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Depth | | | | | | | | | | | | | | | | |
| Addicks loam: | | | | | | | | | | | | | | | | | |
| From Addicks, 3.5 miles | 0-11 | 4.7 | 13.6 | 1.83 | 13.5 | | | 100 | 61 | 51 | 33 | 17 | 13 | 22 | 5 | A-4(6) | CL-ML |
| north on Texas Highway 6 to | 23-49 | 6.8 | 11.0 | 2.03 | 19.2 | 96 | 93 | 90 | 64 | 58 | 45 | 26 | 21 | 23 | 11 | A-6(6) | CL |
| Clay Road, 1.85 miles east | 49-78 | 13.7 | 9.6 | 2.08 | 35.7 | 95 | 93 | 92 | 65 | 56 | 38 | 23 | 10 | 36 | 22 | A-6(16) | CL |
| on Clay Road, then 75 feet into pasture (modal). Texas report no. 1271L-252, 253, 254. | | | | | | | | | | | | | | | | | |
| Aldine very fine sandy loam: | | | | | | | | | | | | | | | | | |
| From Humble, 9.5 miles east | 5-14 | 1.7 | 18.5 | 1.76 | 5.4 | | 100 | 99 | 71 | 53 | 20 | 7 | 5 | 22 | 7 | A-4(8) | CL-ML |
| on FM 1960 to Lake Houston | 20-34 | 19.6 | 10.2 | 1.99 | 47.8 | | 100 | 99 | 83 | 72 | 56 | 45 | 43 | 56 | 34 | A-7-6(19) | CH |
| Drive, then 0.6 mile north | 34-55 | 13.8 | 13.1 | 1.90 | 36.3 | | | 100 | 81 | 68 | 51 | 40 | 38 | 43 | 24 | A-7-6(14) | CL |
| on Lake Houston Drive and 70 feet east in timber (modal). Texas report no. 1271L-309, 310, 311. | | | | | | | | | | | | | | | | | |
| Aris fine sandy loam: | | | | | | | | | | | | | | | | | |
| From Addicks, 3.2 miles | 0-7 | 1.7 | 15.5 | 1.75 | 5.5 | | | 100 | 55 | 44 | 24 | 13 | 10 | 19 | 4 | A-4(4) | CL |
| north on Texas Highway 6 | 21-51 | 13.7 | 14.2 | 1.93 | 35.8 | | | 100 | 69 | 62 | 48 | 40 | 39 | 43 | 24 | A-7-6(14) | CL |
| to Clay Road, 1.8 miles | 51-78 | 15.6 | 13.0 | 1.87 | 40.3 | | | 100 | 62 | 49 | 37 | 27 | 24 | 49 | 31 | A-7-6(20) | CL |
| west on Clay Road to Gertie Rice Road, 0.7 mile north on Gertie Rice Road and 60 feet west in pasture (modal). Texas report no. 1271L-261, 262, 263. | | | | | | | | | | | | | | | | | |
| Beaumont clay: | | | | | | | | | | | | | | | | | |
| From El Lago, 3.0 miles | 0-9 | 21.4 | 9.5 | 1.90 | 51.5 | | 100 | 99 | 96 | 93 | 83 | 71 | 56 | 65 | 42 | A-7-6(20) | CH |
| northwest on Red Bluff Road | 21-43 | 24.6 | 10.3 | 2.01 | 57.6 | | | 100 | 97 | 92 | 87 | 76 | 63 | 77 | 49 | A-7-6(20) | CH |
| to Big Island Slough, 1.35 | 59-73 | 24.5 | 12.7 | 1.99 | 57.2 | | 100 | 99 | 96 | 93 | 82 | 69 | 59 | 80 | 53 | A-7-6(20) | CH |
| miles north to pipeline, then 0.3 mile east and 100 feet south in pasture (modal). Texas report no. 1271L-370, 371, 372. | | | | | | | | | | | | | | | | | |
| Bernard clay loam: | | | | | | | | | | | | | | | | | |
| From Alief, 1.11 miles west | 0-6 | 12.0 | 12.0 | 1.86 | 3.22 | | | 100 | 81 | 67 | 48 | 24 | 22 | 38 | 22 | A-6(13) | CL |
| on Alief Road to Synott | 34-54 | 15.2 | 10.1 | 1.98 | 39.2 | 99 | 99 | 99 | 87 | 75 | 57 | 38 | 36 | 43 | 29 | A-7-6(16) | CL |
| Road then 0.96 mile south | 54-65 | 16.8 | 7.1 | 2.04 | 42.5 | 97 | 94 | 91 | 77 | 68 | 53 | 36 | 34 | 43 | 27 | A-7-6(15) | CL |
| on Synott Road and 80 feet west in field (modal). Texas report no. 1271L-201, 202, 203. | | | | | | | | | | | | | | | | | |

See footnotes at end of table.

TABLE 19.--ENGINEERING TEST DATA--Continued

| Soil name and location | Depth from surface | Shrinkage | | | | Mechanical analysis[1] | | | | | | | | Liquid limit[2] | Plasticity index | Classification | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Linear | Limit[2] | Ratio | Volumetric | Percentage passing sieve-- | | | | Percentage smaller than-- | | | | | | AASHTO[3] | Unified[4] |
| | | | | | | No. 4 | No. 10 | No. 40 | No. 200 | 0.05 mm | 0.02 mm | 0.005 mm | 0.002 mm | | | | |
| | Depth | | | | | | | | | | | | | | | | |
| Hockley fine sandy loam: | | | | | | | | | | | | | | | | | |
| From Tomball, 8.1 miles east on FM 2920 (Tomball-Waller Road), then 75 feet south in pasture (modal). Texas report no. 1271L-212, 213, 214. | 0-5 | 1.1 | 21.6 | 1.82 | 3.2 | | 100 | 99 | 51 | 33 | 23 | 6 | 5 | 19 | 6 | A-4(4) | CL-ML |
| | 21-47 | 6.7 | 11.7 | 1.95 | 18.9 | 96 | 93 | 92 | 57 | 46 | 33 | 17 | 16 | 23 | 11 | A-6(5) | CL |
| | 47-70 | 5.7 | 15.9 | 1.83 | 16.3 | 73 | 63 | 60 | 38 | 30 | 22 | 15 | 14 | 26 | 9 | A-4(3) | SC |
| Ijam clay: | | | | | | | | | | | | | | | | | |
| From Baytown, 0.81 mile east on East Texas Avenue and 1,000 feet southwest to Roseland Park headquarters, then 1,000 feet south and 500 feet east in barren dredge site (modal). Texas report no. 1271L-352, 353. | 0-8 | 19.3 | 5.8 | 2.05 | 47.3 | 99 | 99 | 98 | 72 | 57 | 40 | 30 | 28 | 50 | 35 | A-7-6(16) | CL-CH |
| | 8-60 | 25.2 | 8.0 | 2.09 | 60.0 | | | 100 | 97 | 92 | 86 | 63 | 58 | 79 | 58 | A-7-6(20) | CH |
| Kaman clay: | | | | | | | | | | | | | | | | | |
| From Crosby, 3.32 miles south on FM 2100 to Highland Shores Road, then 0.6 mile west on Highland Shores Road and 200 feet north in pasture (modal). Texas report no. 1271L-207, 208, 209. | 0-5 | 21.7 | 9.5 | 1.98 | 51.9 | | 100 | 98 | 87 | 82 | 74 | 55 | 52 | 64 | 40 | A-7-6(20) | CH |
| | 39-52 | 18.6 | 10.6 | 1.98 | 46.1 | | 100 | 96 | 82 | 77 | 66 | 45 | 43 | 54 | 38 | A-7-6(19) | CH |
| | 52-70 | 19.0 | 6.2 | 2.12 | 47.0 | 99 | 99 | 94 | 78 | 72 | 62 | 43 | 40 | 48 | 33 | A-7-6(18) | CL |
| Katy fine sandy loam: | | | | | | | | | | | | | | | | | |
| From Addicks, 2.5 miles west on Interstate Highway 10 to Barker-Clodine Road, 2.2 miles south on Barker-Clodine Road, then 1.0 mile east and 100 feet south in pasture (modal). Texas report no. 1271L-367, 368, 369. | 0-12 | 0.0 | 23.1 | 0.00 | 1.6 | | | 100 | 39 | 24 | 6 | 3 | 3 | 22 | 3 | A-4(1) | SM |
| | 37-48 | 16.8 | 11.1 | 1.99 | 42.5 | | | 100 | 60 | 53 | 41 | 32 | 30 | 49 | 29 | A-7-6(14) | CL |
| | 48-65 | 12.8 | 15.7 | 1.91 | 33.7 | | | 100 | 59 | 47 | 38 | 27 | 26 | 42 | 27 | A-7-6(12) | CL |

See footnotes at end of table.

TABLE 19.--ENGINEERING TEST DATA--Continued

| Soil name and location | Depth from surface | Shrinkage: Linear | Shrinkage: Limit[2] | Shrinkage: Ratio | Shrinkage: Volumetric | Mechanical analysis[1]: Percentage passing sieve--No. 4 | No. 10 | No. 40 | No. 200 | Percentage smaller than--0.05 mm | 0.02 mm | 0.005 mm | 0.002 mm | Liquid limit[2] | Plasticity index | Classification: AASHTO[3] | Classification: Unified[4] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Depth | | | | | | | | | | | | | | | | |
| Kenney loamy fine sand: From Spring, 3.75 miles west on Spring-Stuebner Road to Rothwood Road, 1.8 miles north on Rothwood Road and 40 feet west in timber (modal). Texas report no. 1271L-347, 348. | 9-56 | 1.7 | 18.3 | 1.83 | 5.2 | | 100 | 99 | 21 | 4 | 1 | 0 | 0 | 21 | 7 | A-2-4(0) | SM-SC |
| | 56-80 | 3.5 | 18.6 | 1.71 | 10.4 | | | 100 | 34 | 24 | 15 | 12 | 12 | 25 | 9 | A-2-4(0) | SC |
| Lake Charles clay: From Alief, 1.11 miles west on Alief Road to Synott Road, then 1.37 miles north on Synott Road and 75 feet west in pasture (modal). Texas report no. 1271L-198, 199, 200. | 0-22 | 26.2 | 12.5 | 2.02 | 60.0 | | | 100 | 96 | 67 | 64 | 57 | 55 | 87 | 60 | A-7-6(20) | CH |
| | 36-52 | 29.9 | 6.0 | 2.23 | 65.7 | 99 | 99 | 98 | 92 | 86 | 79 | 61 | 56 | 92 | 66 | A-7-6(20) | CH |
| | 52-74 | 29.0 | 6.3 | 2.14 | 64.6 | 95 | 94 | 93 | 90 | 87 | 84 | 71 | 66 | 91 | 64 | A-7-6(20) | CH |
| Midland silty clay loam: From Seabrook, 1.4 miles north on Texas Highway 146 to Red Bluff Road, then 0.32 mile west on Red Bluff Road and 150 feet south in pasture (modal). Texas report no. 1271L-306, 307, 308. | 0-7 | 12.0 | 12.0 | 1.75 | 32.0 | | | 100 | 87 | 41 | 38 | 16 | 12 | 39 | 20 | A-6(12) | CL |
| | 20-37 | 16.0 | 8.3 | 2.05 | 40.9 | | 100 | 99 | 90 | 78 | 71 | 48 | 44 | 42 | 24 | A-7-6(14) | CL |
| | 50-72 | 16.6 | 13.1 | 1.99 | 42.2 | 100 | 100 | 99 | 90 | 81 | 68 | 46 | 44 | 50 | 33 | A-7-6(18) | CL-CH |
| Ozan loam: From intersection of Liberty County line and Huffman-Cleveland Road (northeast corner of Harris county), 1.27 miles south on Huffman-Cleveland Road and 75 feet east in timber (modal). Texas report no. 1271L-349, 350, 351. | 2-8 | 0.0 | 17.9 | 1.83 | 0.0 | | 100 | 99 | 71 | 56 | 34 | 7 | 5 | 17 | 3 | A-4(8) | ML |
| | 18-51 | 3.9 | 14.2 | 1.85 | 11.1 | | 100 | 99 | 78 | 65 | 46 | 19 | 16 | 21 | 7 | A-4(8) | CL-ML |
| | 51-65 | 9.7 | 17.8 | 1.78 | 26.6 | | 95 | 99 | 80 | 68 | 49 | 23 | 20 | 33 | 19 | A-6(12) | CL |

See footnotes at end of table.

TABLE 19.--ENGINEERING TEST DATA--Continued

| Soil name and location | Depth from surface | Shrinkage: Linear | Shrinkage: Limit[2] | Shrinkage: Ratio | Shrinkage: Volumetric | Mechanical analysis[1] Percentage passing sieve--: No. 4 | No. 10 | No. 40 | No. 200 | Percentage smaller than--: 0.05 mm | 0.02 mm | 0.005 mm | 0.002 mm | Liquid limit[2] | Plasticity index | Classification: AASHTO[3] | Classification: Unified[4] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Depth | | | | | | | | | | | | | | | | |
| Segno fine sandy loam: From Huffsmith, 3.25 miles southeast on Huffsmith Road to Kay Kendall Road, then 1.4 miles north on Kay Kendall Road and 75 feet west in timber (modal). Texas report no. 1271L-204, 205, 206. | 0-5 | 0.2 | 18.5 | 2.52 | 0.8 | 95 | 94 | 92 | 39 | 23 | 8 | 1 | 0 | 19 | 4 | A-4(0) | SM-SC |
| | 25-42 | 10.0 | 11.5 | 1.95 | 27.3 | 92 | 86 | 84 | 53 | 42 | 34 | 23 | 22 | 31 | 17 | A-6(6) | CL |
| | 60-75 | 13.0 | 12.3 | 1.89 | 34.4 | | | 100 | 55 | 41 | 33 | 32 | 32 | 40 | 24 | A-6(9) | CL |
| Vamont clay: From La Porte (Main Street) 3.35 miles south on Texas Highway 146, then 75 feet west in pasture (modal). Texas report no. 1271L-215, 216, 217. | 0-4 | 16.8 | 10.8 | 1.93 | 42.4 | | | 100 | 83 | 72 | 51 | 31 | 29 | 49 | 28 | A-7-6(17) | CL |
| | 10-18 | 14.3 | 14.8 | 1.83 | 37.3 | | | 100 | 89 | 73 | 62 | 47 | 45 | 48 | 30 | A-7-6(18) | CL |
| | 50-65 | 24.3 | 8.2 | 2.00 | 56.7 | | | 100 | 84 | 85 | 70 | 63 | 61 | 74 | 54 | A-7-6(20) | CH |
| Voss sand: From Sheldon (U.S. Highway 90), 3.53 miles northeast on Magnolia Gardens Road and 100 feet west in timber (modal). Texas report no. 1271L-210, 211. | 0-5 | 1.6 | 14.2 | 1.81 | 4.9 | | 100 | 69 | 13 | 11 | 7 | 1 | 0 | 18 | 6 | A-2-4(0) | SM |
| | 30-70 | 0.0 | 22.4 | 1.71 | 0.0 | | 100 | 80 | 5 | 1 | 0 | 0 | 0 | 21 | 6 | A-2-4(0) | SP-SM |
| Wockley fine sandy loam: From Hockley, 1.1 miles southeast on U.S. Highway 290 to Zube Road, then 850 feet east on Zube Road and 30 feet north in pasture (modal). Texas report no. 1271L-344, 345, 346. | 8-17 | 0.0 | 20.2 | 1.65 | 0.0 | 99 | 98 | 97 | 64 | 51 | 26 | 13 | 11 | 17 | 4 | A-4(6) | CL-ML |
| | 17-31 | 6.0 | 12.5 | 1.87 | 17.2 | 99 | 98 | 97 | 67 | 56 | 35 | 24 | 22 | 24 | 10 | A-4(7) | CL |
| | 50-65 | 8.3 | 13.4 | 1.92 | 23.0 | 90 | 84 | 83 | 60 | 51 | 35 | 23 | 21 | 29 | 17 | A-6(8) | CL |

[1] Mechanical analyses according to the AASHTO Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

[2] Test procedures may cause minor differences in shrinkage limit, liquid limit, and computed plasticity index.

[3] Based on the Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHTO Designation M 145-49.

[4] Based on the Unified Soil Classification System, Technical Memorandum No. 3-357, Volume 1, Waterways Experiment Station, Corps of Engineers, March 1953.

TABLE 20.--CLASSIFICATION OF THE SOILS

| Soil name | Family or higher taxonomic class |
|---|---|
| Addicks | Coarse-loamy, siliceous, thermic Typic Argiaquolls |
| Aldine | Fine-silty over clayey, siliceous, thermic Aeric Glossaqualfs |
| Aris | Fine, mixed, thermic Typic Glossaqualfs |
| Atasco | Fine, mixed, thermic Aquic Glossudalfs |
| Beaumont | Fine, montmorillonitic, thermic Entic Pelluderts |
| Bernard | Fine, montmorillonitic, thermic Vertic Argiaquolls |
| Bissonnet | Fine-silty, siliceous, thermic Aeric Glossaqualfs |
| Boy | Loamy, siliceous, thermic Grossarenic Plinthic Paleudalfs |
| Clodine | Coarse-loamy, siliceous, thermic Typic Ochraqualfs |
| Edna | Fine, montmorillonitic, thermic Vertic Albaqualfs |
| Gessner | Coarse-loamy, siliceous, thermic Typic Glossaqualfs |
| Harris | Fine, montmorillonitic, thermic Typic Haplaquolls |
| Hatliff | Coarse-loamy, mixed, nonacid, thermic Aquic Udifluvents |
| Hockley | Fine-loamy, siliceous, thermic Plinthic Paleudalfs |
| Ijam | Fine, montmorillonitic, nonacid, thermic Vertic Fluvaquents |
| Kaman | Fine, montmorillonitic, thermic Vertic Haplaquolls |
| Katy | Fine-loamy, siliceous, thermic Aquic Paleudalfs |
| Kenney | Loamy, siliceous, thermic Grossarenic Paleudalfs |
| Lake Charles | Fine, montmorillonitic, thermic Typic Pelluderts |
| Midland | Fine, montmorillonitic, thermic Typic Ochraqualfs |
| Nahatche | Fine-loamy, mixed, nonacid, thermic Aeric Fluvaquents |
| Ozan | Coarse-loamy, siliceous, thermic Typic Glossaqualfs |
| Segno | Fine-loamy, siliceous, thermic Plinthic Paleudalfs |
| Vamont | Fine, montmorillonitic, thermic Aquentic Chromuderts |
| Voss | Mixed, thermic Aquic Udipsamments |
| Wockley | Fine-loamy, siliceous, thermic Plinthaquic Paleudalfs |

# FIGURES

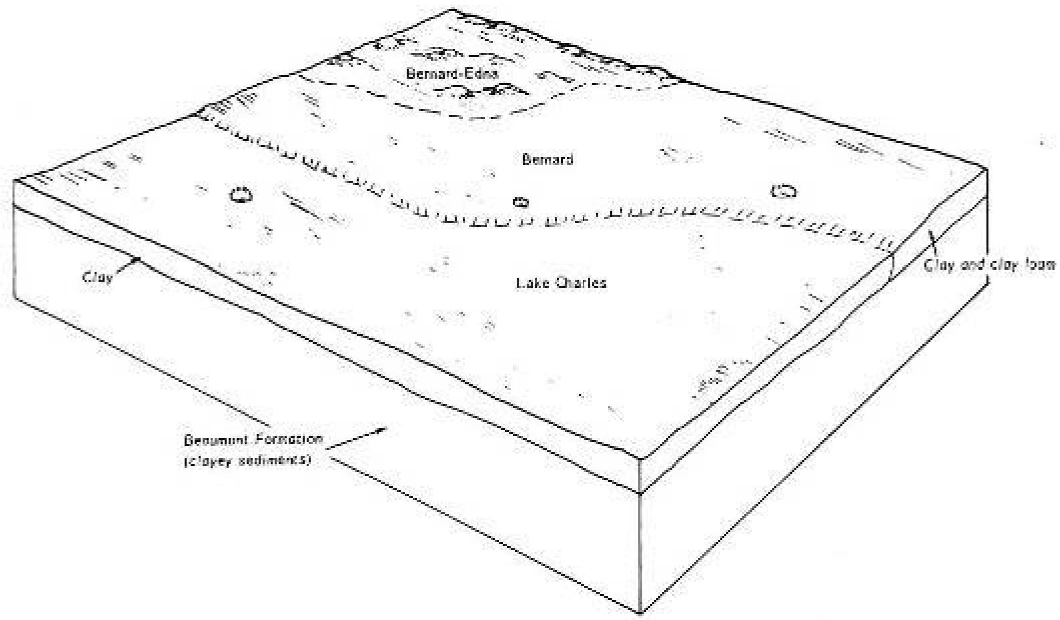


Figure 1. —Typical pattern of soils and underlying material in association 1.

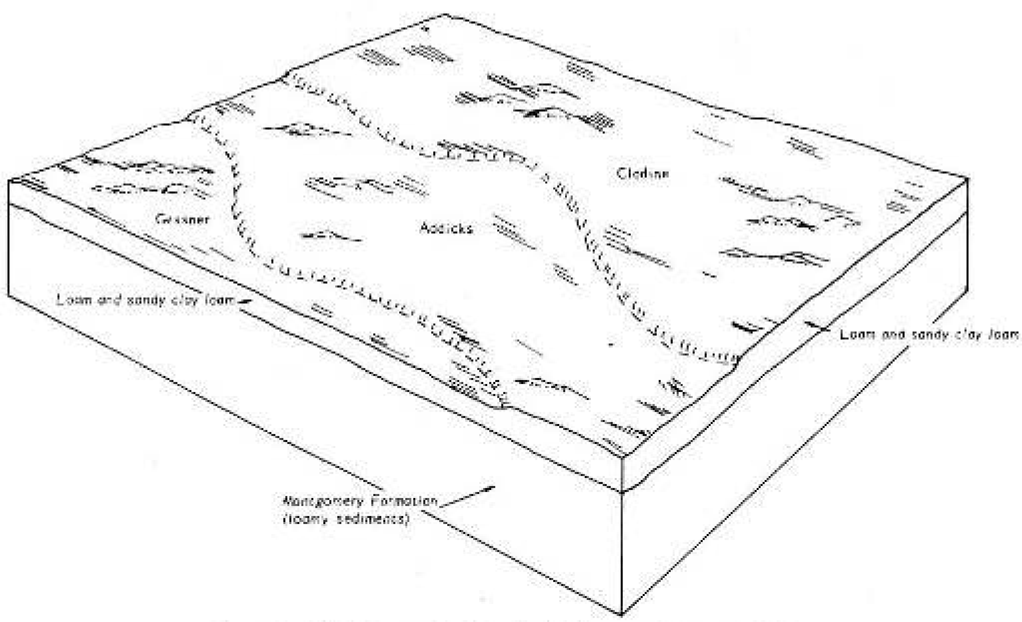


Figure 2. —Typical pattern of soils and underlying material in association 3.

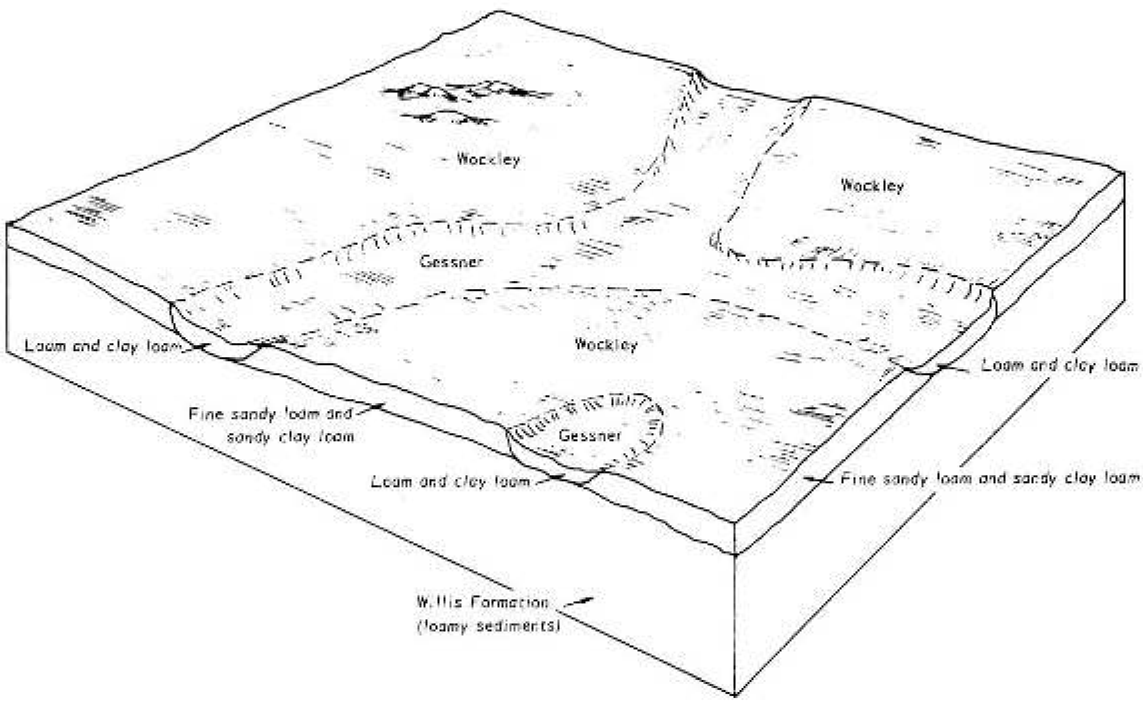


Figure 3. —Typical pattern of soils and underlying material in association 4.

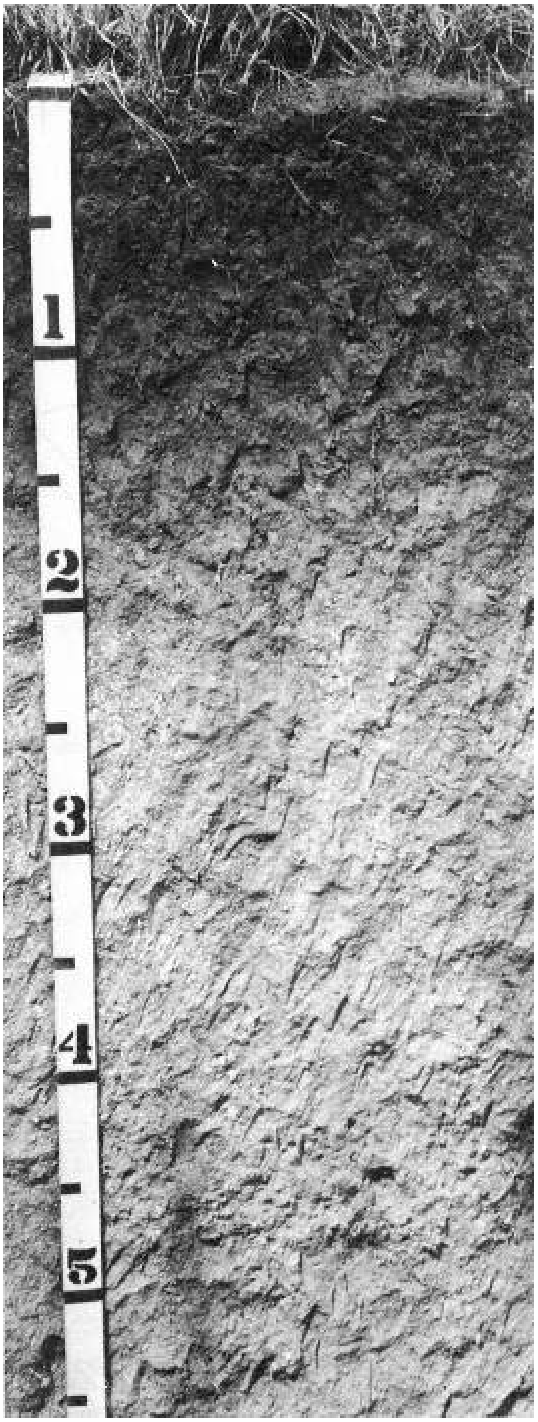

Figure 4.—Profile of Addicks loam. The layer of calcium carbonate enrichment is at a depth of 23 to 49 inches. The vertical dark areas are crayfish krotovinas.

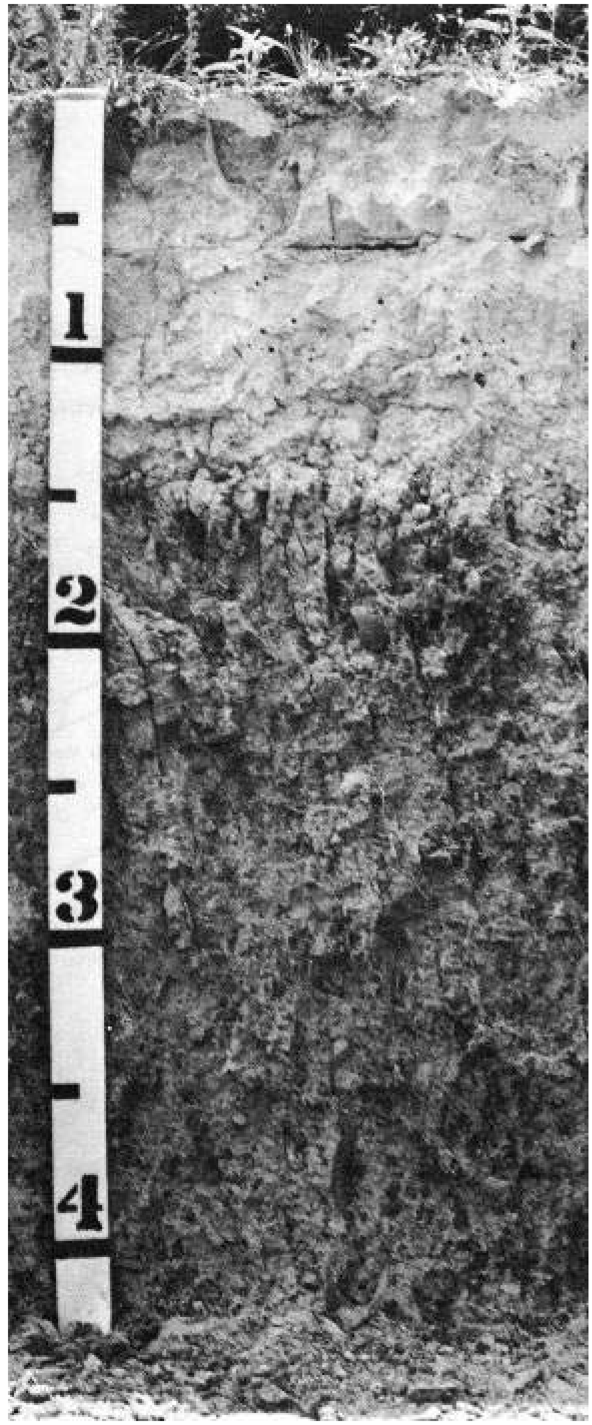

Figure 5.—Profile of Aldine very fine sandy loam. The subsoil of angular blocky clay is at a depth of about 19 inches.


Figure 6.—Profile of Aris fine sandy loam.

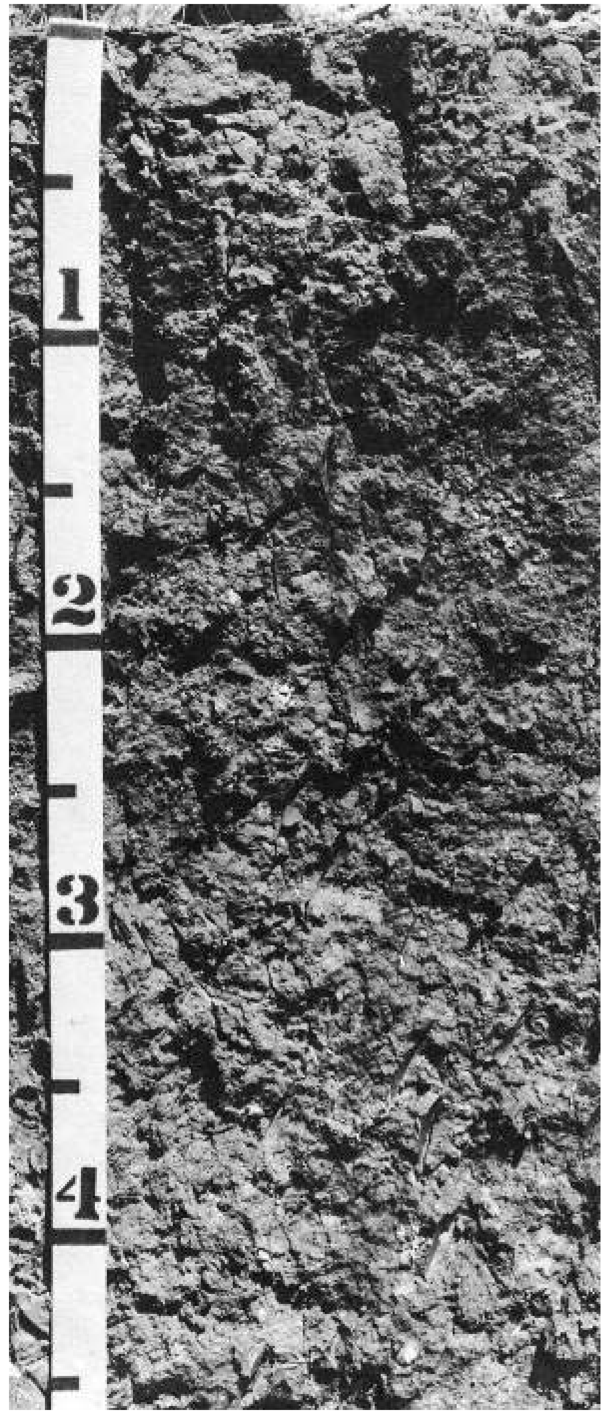


Figure 7.—Profile of Bernard clay loam.

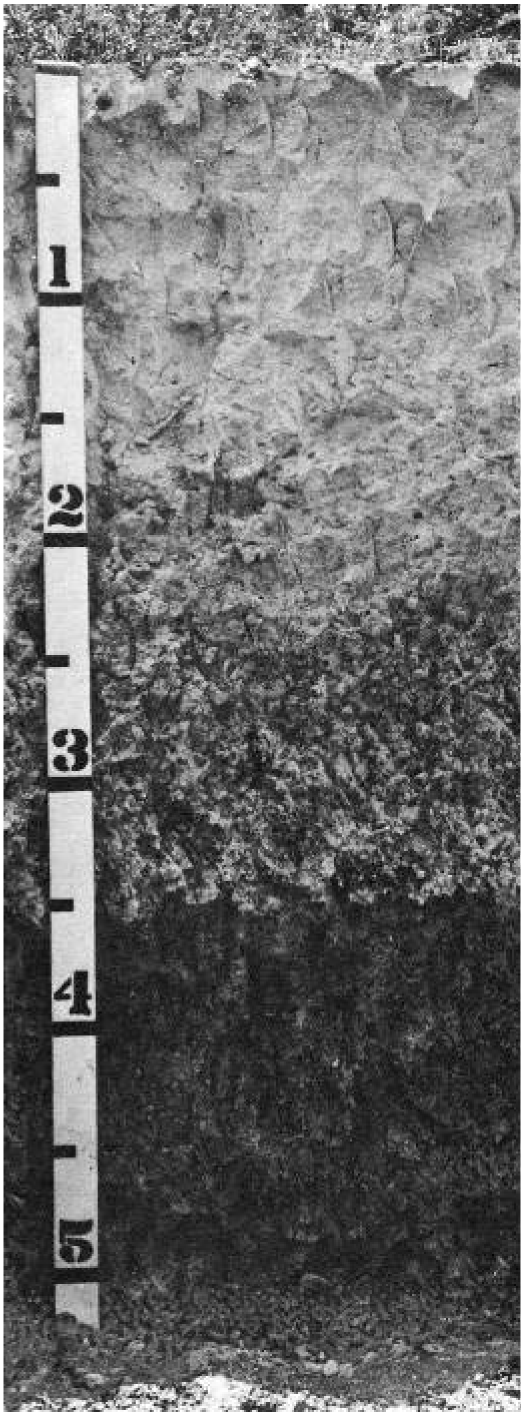

Figure 8.—Profile of Bissonnet very fine loam.

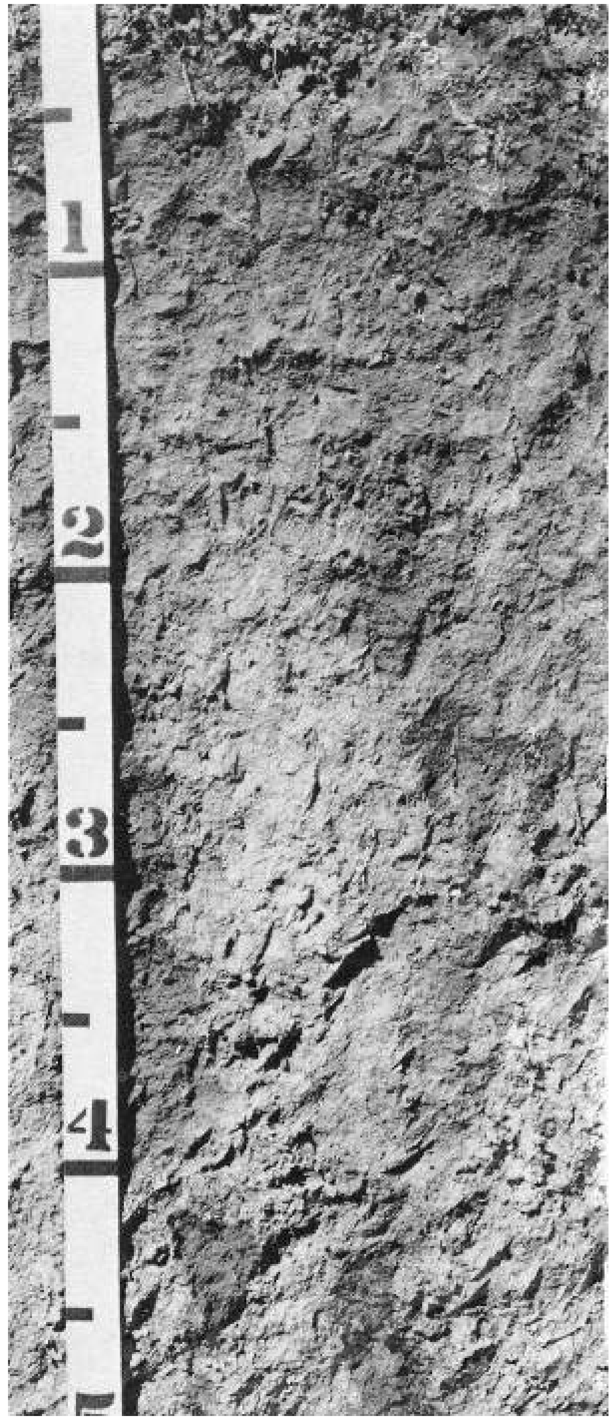

Figure 9.—Profile of Clodine loam. Pitted calcium carbonate concretions are below a depth of 29 inches. Vertical crayfish krotovina are filled with dark loamy material from the surface layer.

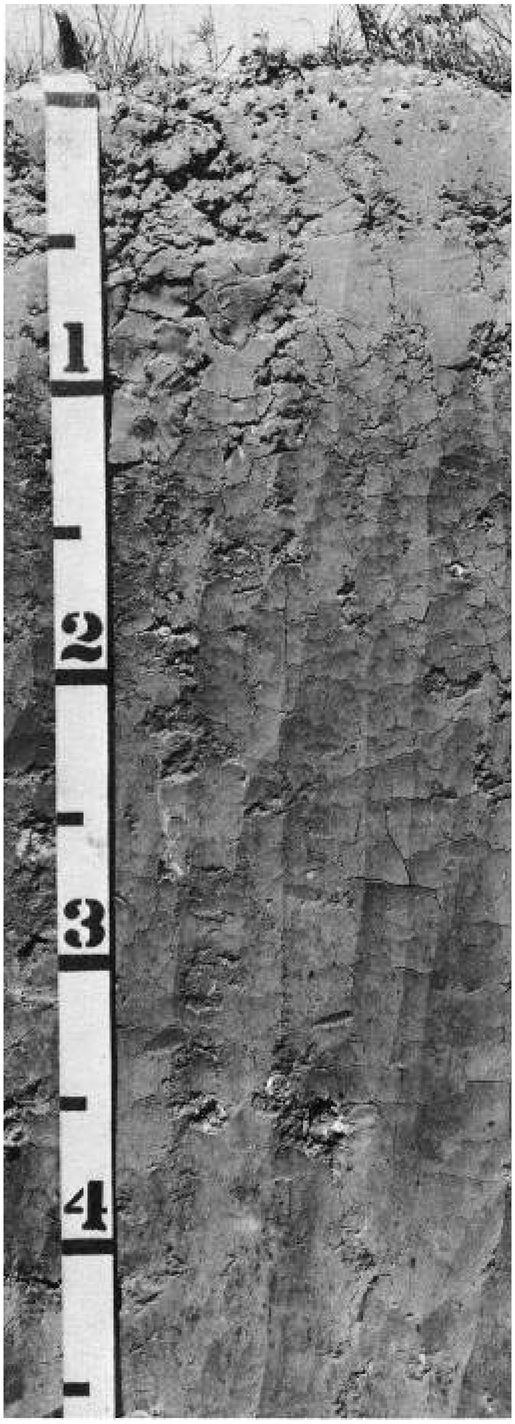


Figure 10.—Profile of Edna fine sandy loam. The surface layer of friable fine sandy loam rests abruptly on the subsoil, which is very firm, angular blocky clay.

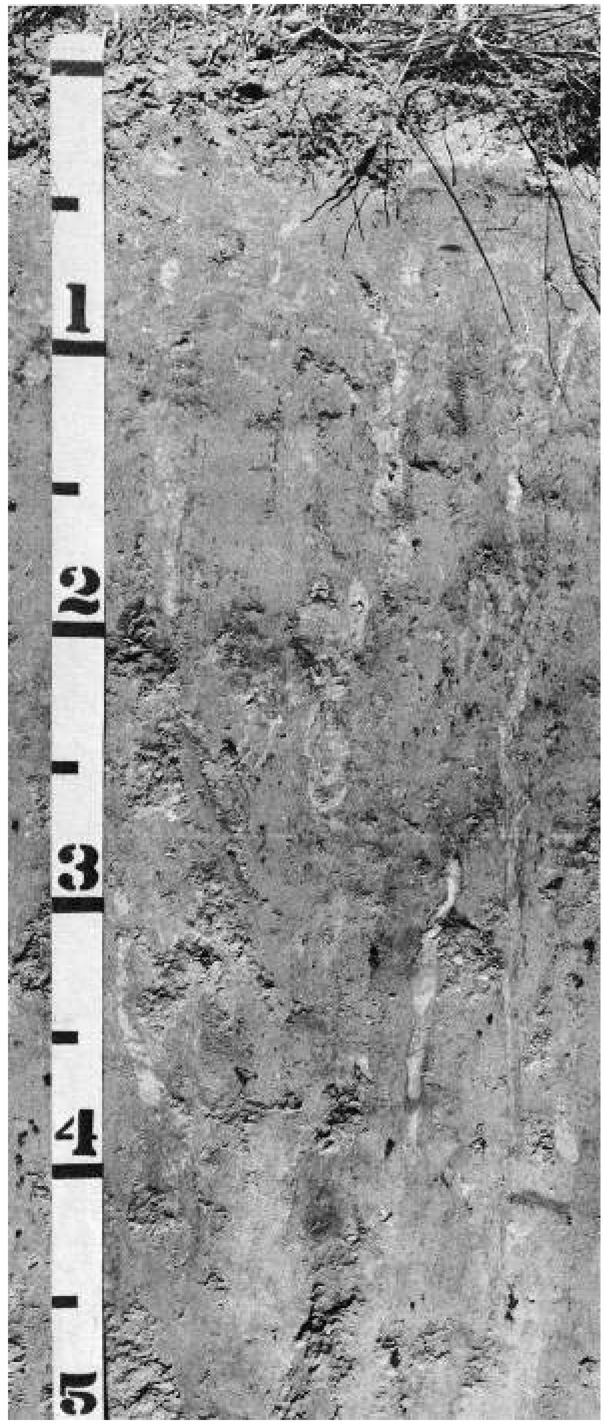


Figure 11.—Profile of Gessner loam. The tonguing and evident of crayfish activity are typical of this soil.

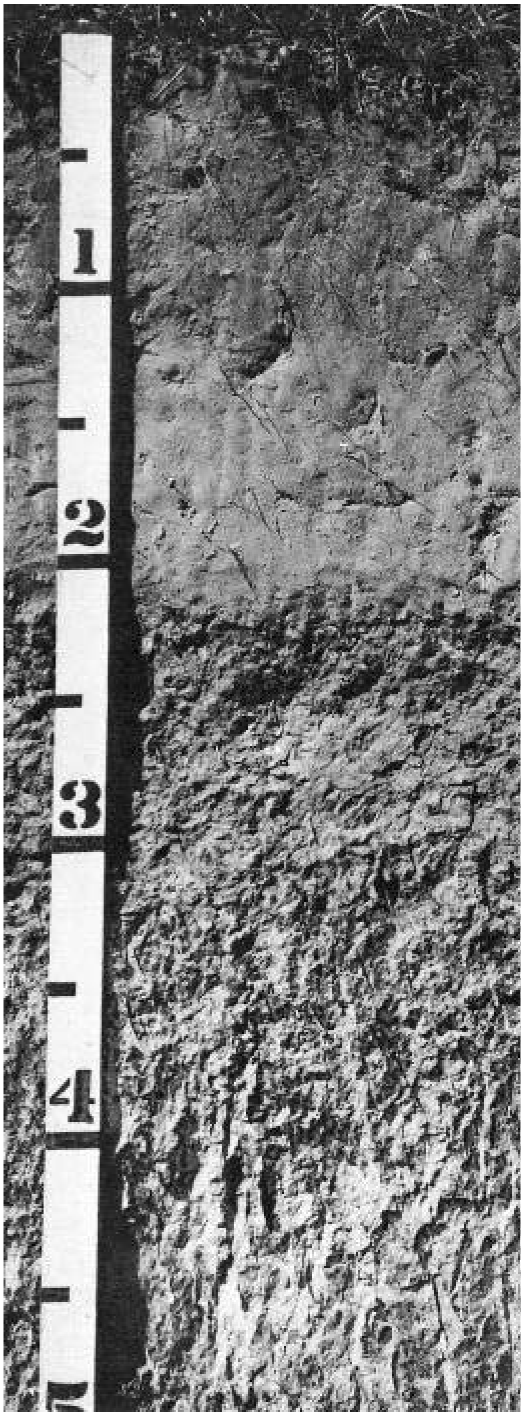

Figure 12.—Profile of Hockley fine sandy loam, 0 to 1 percent slopes.

Figure 13.—Profile of Katy fine sandy loam.

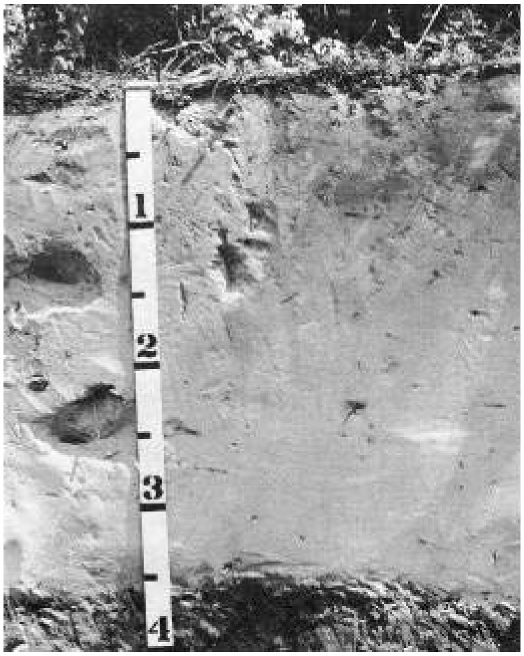

Figure 14.—Profile of Kenney loamy fine sand.

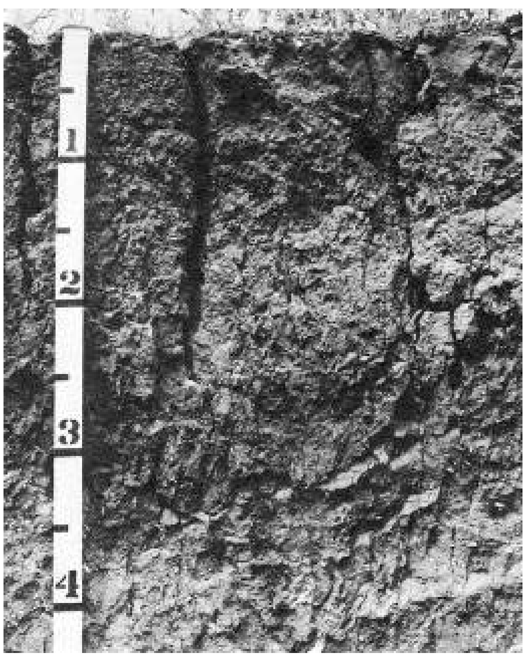

Figure 15.—Profile of Lake Charles clay, 0 to 1 percent slopes. Wide, deep cracks are in the upper layers, and intersecting slickensides are in the lower layers.

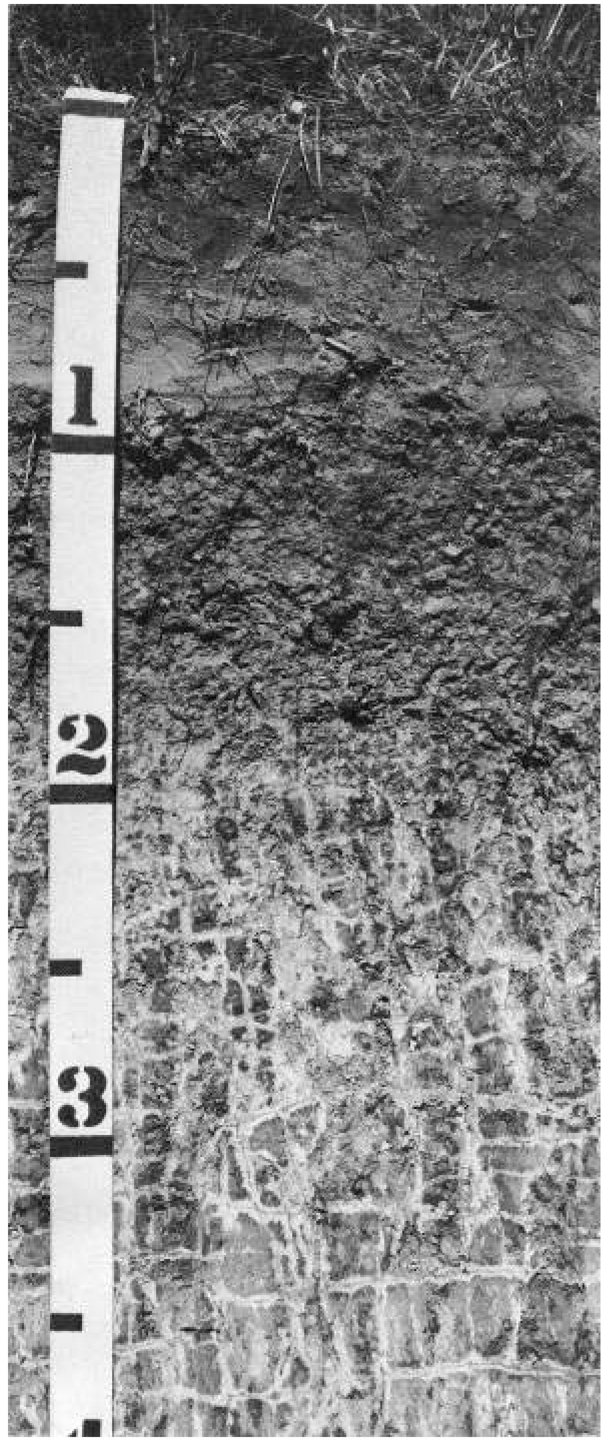

Figure 16.—Profile of Segno fine sandy loam, 0 to 1 percent slopes. The plinthite has a bricklike appearance below a depth of 2 feet.

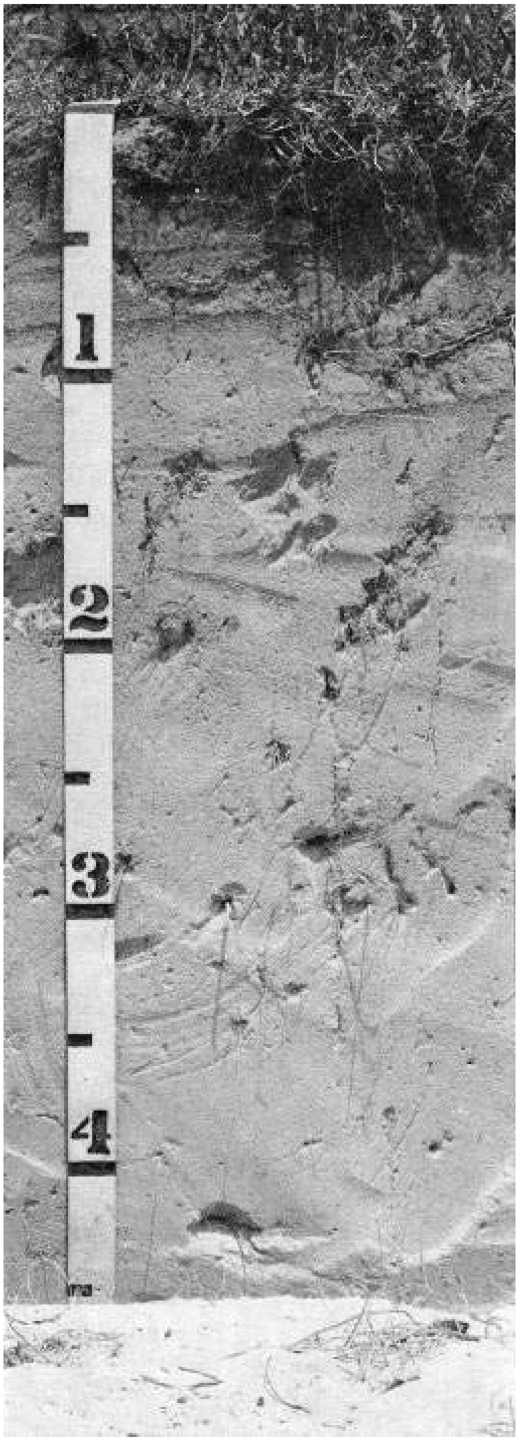


Figure 17.—Profile of Voss sand. The finer textured material is unstratified.

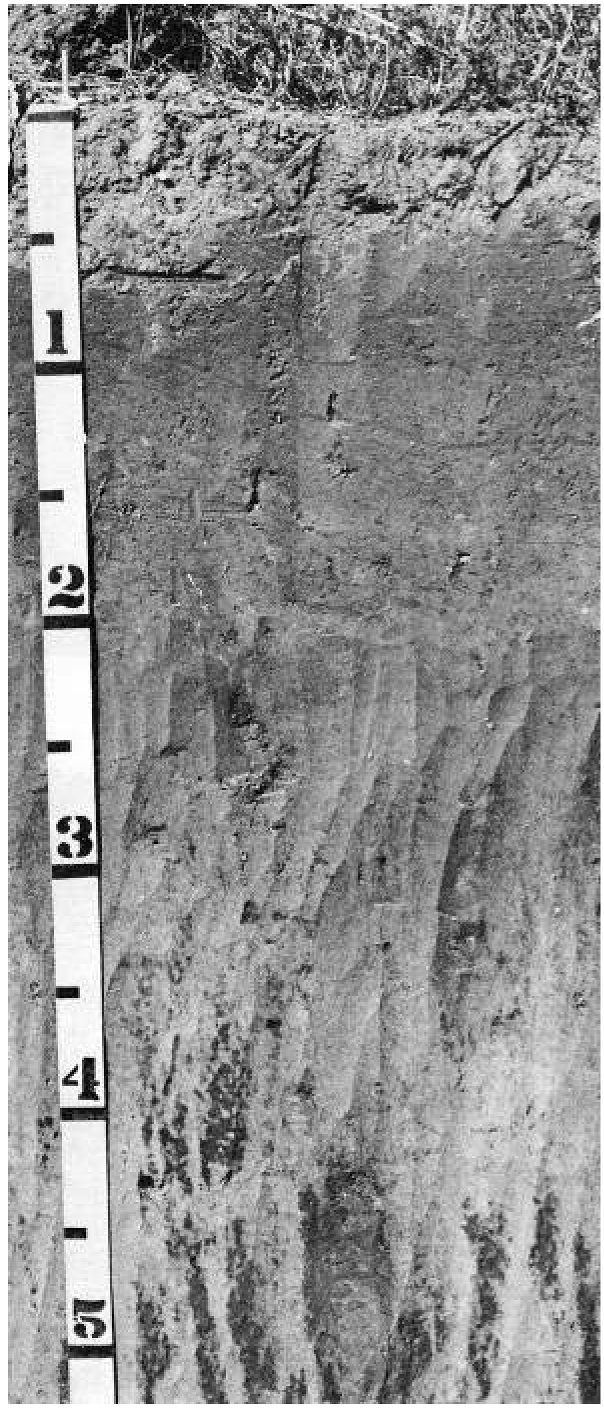


Figure 18.—Profile of Wockley fine sandy loam. The dark areas in the lower park of the profile are plinthite.

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